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VOLUME XVIII

Containing Bibliographies, Digests and Indexes of the Literature of Ophthalmology, for the Year 1921-1922.

Edited by
EDWARD JACKSON

Assisted by
WILLIAM C. FINNOFF

WITH COLLABORATION OF

Hugo W. Aufmwasser, Arthur J. Bedell, William L. Benedict, Conrad Berens, Jr., Burton Chance, William Henry Crisp, William T. Davis, Alexander Duane, Marcus Feingold, L. M. Francis, Sanford R. Gifford, Harry S. Gradle, John Green, Jr., Delamere Forest Harbridge, John F. Hardesty, Emory Hill, Ben Witt Key, Clarence Loeb, John Alexander McCaw, William R. Murray, Florence Mayo Schneideman, Theodore B. Schneideman, James M. Shields, Charles P. Small, Albert C. Snell, Meyer Wiener, William Zentmayer, Charles Zimmermann.

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The Ophthalmic Year Book

This review of the literature of ophthalmology, including the digest of the literature and bibliographies, began with the literature of 1903. In 1918 (Vol. 14) it was merged with other publications to form the AMERICAN JOURNAL OF OPHTHALMOLOGY. Beginning with 1919 it has been published in quarterly parts under the name of OPHTHALMIC LITERATURE, because the postal official in charge objected to admitting to second class rates in the mail, a publication called a "year book."

With the year 1923, the original form of an annual volume will be resumed under the original name of "OPHTHALMIC YEAR BOOK," to be issued as early in the year as is practicable, bringing the references up to those included in the current literature for December, 1922. This will include the literature for some subjects for a whole year, for others for only part of a year; and for some others it will cover the period since such reviews were interfered with by the breaking out of the world war.

The lists of "Current Literature" will be continued monthly in the AMERICAN JOURNAL OF OPHTHALMOLOGY. These lists were started in the form of a monthly journal called "OPHTHALMIC LITERATURE" in 1911; and have been continued under that name, or as a part of the American Journal of Ophthalmology, ever since. Unfortunately the earlier volumes of both the Year Book and Ophthalmic Literature are now out of print, and difficult to obtain.

With the new volume a large part of the labor and responsibility for the "Year Book" are taken up by Dr. William H. Crisp, a colleague with whose work the readers of this publication are already familiar.

E. J.

Arrangement of Contents

The bibliography of each section is arranged alphabetically by authors' name. The digest of the literature gives new facts or theories, and indication of the ground covered by important papers relating to ophthalmology.

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EDWARD JACKSON, M.D.

DENVER, COLORADO

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DIGEST OF THE LITERATURE.

OPHTHALMOSCOPY. Under the title ophthalmoscopy without an ophthalmoscope, **Hairi** describes a method of using the scleral electric lamp of Lange. This is held about 1 cm. in front of the patient's cornea, and the observer bringing his eyes as close to it as is convenient, is able to see the details of the fundus in the erect image. Beginners are thus able to see the fundus image at the first attempt; and it permits the inspection of the fundus to the extreme periphery thru the dilated pupil. For the indirect method the lamp is placed in the same position and the large convex object lens held at the usual distance in front of the eye. The method of making the direct examination is shown in Fig. 1. Hairi has been able by use of the Vogt filter to thus examine the eye with red free light.

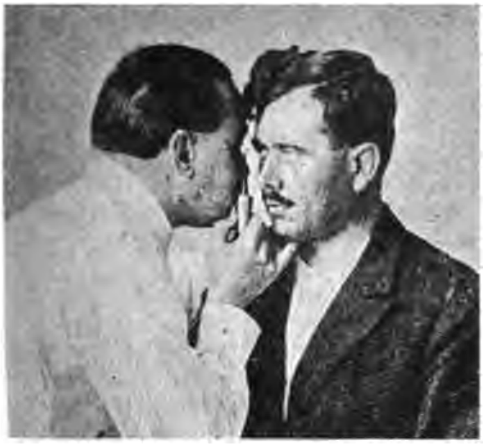

Fig. 1. Method of using Lange's lamp for direct ophthalmoscopic examination. The light is shaded from the surgeon's eye, who looks over it to see the patient's fundus.

Birkhäuser has described an *arc light* in which the carbons are so placed as to give a point of light which may be used with the filter to supply red free light for ophthalmoscopy, as well as for focal illumination.

Attention is called by **Kleefeld** to the difficulties that arise from the visible filament of the *incandescent electric lamp,* and the advantages of the opaline or white glass lamp, because it both conceals the filament and avoids the lateral diffusion which occurs from a ground glass surface.

For a *demonstration ophthalmoscope* and for *photography of the fundus* **Wertheim-Salomonson** uses a reflecting prism placed in front of half of the photographic lens. The ophthalmoscope object lens (indirect method) transmits the light both entering and leaving the eye. To get rid of the reflection from its surfaces, small blackened screens, 1.5 mm. in diameter, are placed so as to cut off these reflections when sharply reproduced by the photographic lens, and a small screen of transparent yellow is placed on the surface of the condensing lens. For ophthalmoscopic demonstrations, a small 1/2 watt lamp is used. But for photography, an arc lamp requiring 6 amperes of current is employed. In either case, the light from the lamp is condensed on an 8 mm. diaphragm, just in front of the reflecting prism. For demonstrations a magnification of 14, equal to that of direct ophthalmoscopy, is commonly used. But it gives a field equal to that of indirect ophthalmoscopy. Exposures of 1/10 to 1/12 seconds are sufficient to give good negatives on panchromatic plates.

Haab has called attention to the advantage of using an *intense light* for the ophthalmoscopic examinations when the media are hazy, so that fundus details will be rendered visible, that cannot be seen by ordinary illumination. He has employed a lamp giving an intensely white light of 200 candle power. He warns the observer to avoid the after image that would result from looking directly at the light. It is less annoying to the patient, who sees it thru hazy media.

Lewis suggests a lens for definitely *locating points* on the eyeground. Squares, each 3 mm. on a side, are etched upon the object lens used for the indirect method. These cast shadows upon the fundus, by means of which any point may be exactly located, and a record made of its position upon a diagram of similar squares upon the record card.

For ophthalmoscopy with *red free or green light,* **Cantonnet** uses a low voltage lamp which can be placed with a rheostat on the ordinary alternating current. The lamp (12 volts) is theoretically 100 candle power, but practically is found to give 150 to 175 c.p. This is placed in an opaque cylinder having an opening which is screened with a green glass, that excludes all red and most of the orange light, or with a blue-green glass which entirely excludes such light but slightly diminishes the illumination. The only inconvenience is that the light is projected in a pencil of rays 7 or 8 cm. in diameter, and the patient is likely to move slightly, so that the direction of the pencil requires a readjustment, but this is very quickly accomplished.

A rheostat for controlling the current in the use of Simon's electric ophthalmoscope has been demonstrated by **Passow.** **Nivault** has reported observations made with the apparatus described by Cantonnet on normal and pathologic eyes. He finds it superior for detecting conditions of the retina, as it is a practical clinical instrument, while the arc lamp is more suited to the laboratory. Green light is not so well suited for examinations of changes in the choroid, and therefore cannot replace ordinary methods of illumination.

Koby confirms all that Vogt has claimed for red free light in revealing opacities in the media. Minute precipitates on the posterior surface of the cornea appear black against the green ground, and fine opacities in the crystalline lens and vitreous come out distinctly. New formed vessels and small retinal hemorrhages become more evident than with ordinary illumination, since they appear black against the green ground. The exaggeration of the preretinal reflexes is very marked, the nerve fibers in the retina and the changes in them are more noticeable, and slight foldings of the retina become evident. The yellow color of the macula throws into relief relatively slight alterations of the fovea, as cystic degeneration of this region, which may precede perforation.

For ophthalmoscopy by green light **Dameno** and **Barassi** have used the lamp made by Malardeau of Paris for this purpose, which uses a crystal of Isly and screens out all red and near red radiations. They confirm the reports of other observers with regard to the appearances thus revealed and their significance.

The *suspension of the red corpuscles* in the blood plasma varies in stability. Fohraeus has demonstrated that in pregnant women the settling of the corpuscles is much more rapid than in other healthy persons. By pinching a superficial vein in the forearm, he demonstrated the separation of the corpuscles, and their accumulation in the lower part of the blood column that was interrupted, by change in the color of the included portion of the vessels. **Ploman** has sought to demonstrate such changes by interruption of the blood current in the retinal vessels, after having failed to do so in the conjunctival vessels, because of their numerous anastomoses.

He made pressure upon the eyeball until pulsation appeared in the retinal arteries and the flow of the blood became interrupted. Under this pressure the appearance of the blood column became granular, so that it resembled a flow of "red sand;" and as the pressure was continued, the granulation became more coarse. Sometimes the blood column was completely divided into segments, as is seen after obstruction of the retinal arteries. The phenomena were produced in both arteries and veins, and the color of the blood in the arteries became darker, until they could not be distinguished from the veins. By means of an electric apparatus, including a chronograph registering each 1/5 of a second, Ploman studied the time required to produce physical changes in the blood column. He also drew a small portion of blood from each of the persons so examined, mixing it with four times its bulk of a 2% solution of sodium citrat, and noted the rapidity of the settling of the red blood cells in a vertical tube. The changes in the retinal blood column were always noticeable in 45 or 50 seconds. He found the settling of the corpuscles *in vitro* corresponded in relative time to the ophthalmoscopic changes in different individuals, and that both were much more rapid in pregnant women. His observations were made upon 39 men and 28 women.

The examination of the *angle of the anterior chamber* with the ophthalmoscope has been used and demonstrated by **Uribe-Troncoso**, who employes Koeppe's socalled contact glass, a form of orthoscope, and the electric ophthalmoscope, using the direct method and a lens of 20 to 40 diopters. This plan he finds quite superior to that suggested by Salzmann. By it he was able to demonstrate the presence of the Schlemm canal, which he has never found to contain blood. He also observed the angle of the anterior chamber quite free from obstruction in chronic simple glaucoma.

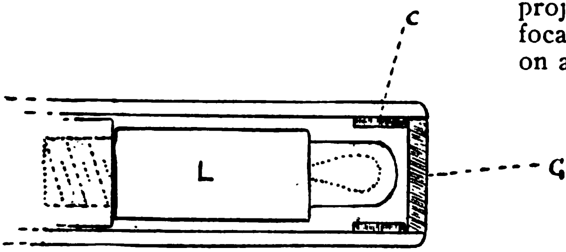

Fig. 2. Section of Graves' instrument for contact illumination. L, Lamp socket in end of tube. C, Metal collar against which flat glass plate (G) abuts, giving smooth end for contact with tissues.

A new form of instrument for *skiascopy* is suggested by **Bennett.** He combines a plane mirror with a convex lens of 1 d. strength silvered on its convex surface. These two mirrors are placed back to back with a common sight hole. It gives both a plane and concave mirror in one instrument, readily covered by a folding handle to carry in the pocket; and the advantage of a convex lens to render observations more definite for the presbyopic observer. **Galloway** has written on retinoscopy for school examinations of the eye, and **Taylor** on a retinoscope lens holder.

Focal Illumination. The many important observations that have been made by what is called *microscopy of the living eye* depend upon improved focal illumination. The improvement has been made in two ways; increased brilliancy of the light, and sharp limits to the incident pencil. These were what Gullstrand secured by his adapted Nernst slit lamp; and the same advantages at less expense and in more practical form are being sought by other methods of illumination. **Danis** points out that the small monocular ophthalmoscope of Gullstrand, which is supplied with a 4 volt lamp having a straight metallic filament and an appropriate lens system to project the light, furnishes an excellent focal illumination. He uses it mounted on a special stand and placed about 45 cm. from the eye to be examined. The aspherical lens, which has a focus of 6 cm. distance, is held perpendicular to the light pencil, at about its focal distance from the eye. The light areas thus secured may be thrown on the cornea, anterior chamber, iris or crystalline lens, producing either direct or indirect illumination sufficient for the use of a good binocular loupe.

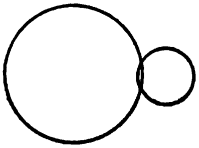

Fig. 3. Diagram of cornea and end of tube at its edge.

For the examination of the anterior segment of the eye, especially the cornea, **Graves** recommends what he calls *"contact illumination."* He secures it with a tube shown in Fig. 2, which ends in a plate of glass very neatly fitted and smooth, so that it can be pressed directly against the cornea and conjunctiva. Within this tube a second one slides, carrying in its end an electric lamp, and its connecting wires. The inner tube can be pushed up to the glass or drawn back from it according to the illumination required. He uses a 4-volt lamp, similar to those used in some electric ophthalmoscopes. which works on a 2 cell storage battery or three dry cells. The whole instrument is about 12 cm. long and 8 mm. outside diameter. To bring out slight opacities in the cornea, this lamp is placed in contact with the sclera, with only its edge overlapping the cornea as shown in Fig. 3. This lights up the opacity, without any illumination of the background and surrounding parts which would tend to make the opacity invisible. By shifting the position of the illuminator, an excellent light is obtained for the examination of other parts of the anterior segment of the eye, with a monocular or binocular magnifier, giving as much as 10 diameters enlargement.

The source of light best suited for microscopy of the living eye, has been the subject of considerable experiment on the part of **Vogt.** He believes that the Nernst slit lamp will soon be superseded by the nitra lamp and the microarc lamp. The former, being the simpler and more convenient, will be preferable for many clinical investigations. But for slight opacities of the media and appearances requiring the higher degrees of magnification, the small arc lamp will be found distinctly superior, because it is ten times as bright as the other. As to the danger of excessively bright light in this connection, his experience of 3 years has yielded no evidence of it. **Vogt** also discusses the confusing and misleading appearances due to defects inherent in the illumination, especially by the nitra lamp; and those that arise within the eye thru shadows, reflections from various surfaces, and by refraction of rays altering apparent depth, foreshortening, etc.

The books upon this subject that have been published by **Koeppe** (310 pages) and **Vogt** (154 pages) cannot be summarized here. But **Marin Amat,** reporting Koeppe's lectures in Spain, **Hertel** and **Chacon** have each given a good brief review of the leading achievements of this new method of examining the eye. In the main they bear upon the normal and pathologic histology of parts examined, can best be studied with the apparatus and the eyes themselves, aided by one of these accounts of what may be looked for. As the significance of the different appearances becomes clear, it will be referred to in the diagnosis of particular diseases. The same is true of **Vogt's** papers on the results of slit lamp microscopy, of which his book constitutes a summary.

Schnyder has discussed the historic development of the technic of slit lamp microscopy. **Streuli** has described a relatively simple form of arc light, that can be used for microscopy of the living eye or for ophthalmoscopy by red free light. **Koeppe** has demonstrated and explained the use of Zeiss' "bitumi" and "orthobitumi" eye-pieces for microscopy of the living eye, and both he and Vogt have indulged in controversial communications on slit lamp microscopy. In this country **Von der Heydt** and **Gradle** have described slit lamp microscopy, and contributed clinical observations with regard to it. **Sonnenfeld** has written on monolenticular magnifiers.

Meesmann reports some clinical observations upon cases of detached retina and macular disease by focal illumination, using the "nitra" slit lamp and the special apparatus employed by Koeppe. In a case of luetic iridocyclitis, with detachment of the retina and great retraction of the lens, new formed vessels were seen on the surface of the retinal detachment and fibers proceeding from it thru the vitreous. In another case of retinal detachment, there was also striking enlargement of the lymph sheaths of the veins. In a case of macular disease, looking like a hole in the macula, this method of examination showed swelling and pigmentation.

Batten has called attention to the value of the *hydrophthalmoscope* in that it gives a clear view of the fundus with the ophthalmoscope, or by oblique illumination, in high degrees of myopia and in cases of irregular distortion of the cornea; and it also gives a clear view of the extreme angle of the anterior chamber. It is applied directly to the anterior segment of the eyeball like an eye cup, except that the lids are drawn apart so that it comes in direct contact with the globe. It has a plane glass front thru which the examination is made. **Amsler** calls attention to the use of a modified *Placido disc* to examine the corneal surface, the condition of the epithelium and loss of substance or irregularities of the cornea. This method of examination he calls keratoscopy.

Transillumination. In examining the eye by oblique focal illumination, one often observes on the sclera opposite the light a spot brightly illuminated by light entering the pupil and focussed upon it. Upon this basis, **Lindahl** has elaborated a method which he designates pupillary transillumination of the anterior scleral wall. He has also with a lamp of his own design developed Lange's method of transillumination, and uses the Gullstrand slit lamp as a source of light to be reflected into the eye by an ophthalmoscopic mirror thru the pupil. By these different methods, he is able to demonstrate intraocular tumors in all parts of the eyeball, to determine if they contain pigment, and also to recognize detachment and coloboma of the ciliary body and anterior choroid, and to localize foreign bodies lying close to the scleral wall. Lange determined the presence of intraocular tumor by its interruption of the pupillary illumination when the light was applied over the area of the tumor. Lindahl illuminates the interior of the eye and notes the interruption of scleral illumination over the tumor region. **Clarke** has called attention to a simple method of converting the electric ophthalmoscope into a transilluminator.

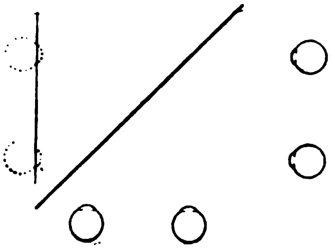

Fig. 4. Diagram showing eyes of patient below, their reflection to the left, and eyes of surgeon to the right. Oblique line represents mirror.

Pupillometers. After a review of the many instruments previously devised for the measurement of the pupil, **Kleefeld** describes one which he calls a universal pupillometer for the exact observation and record of the size and changes of the pupil under carefully controlled conditions. The size is observed with the aid of the pupillometer of Haab, and is recorded by the electric perforation of a roll of paper which carries a chronographic record. Light may be thrown on the center, the periphery, or any part of the retina. The instrument can be used to test the visual acuity, color sense, light sense or power of adaptation. It can scarcely be regarded as adapted for clinical use.

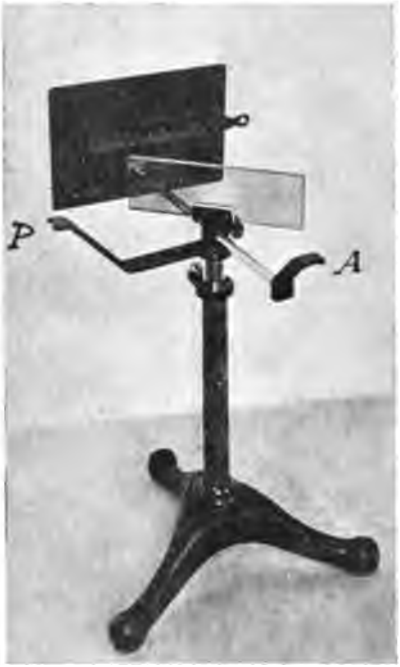

Fig. 5. Trendelenberg's completed instrument. A, Position of surgeon; P, Patient whose eyes are seen in the mirror apparently in the position of the scale upon which they are measured.

To measure the size of the pupils and corneas, the distance between them and the prominence of the eyes, **Trendelenberg** has used an arrangement diagramatically represented in Fig. 4. The patient and surgeon both look at a mirror placed at an angle of

45 degrees with their visual axes. The mirror is thinly coated, so that it reflects half the light and permits an equal portion to pass thru it. The surgeon sees an image of the patient's eyes and holds across that image a graduated rule from which he can read the desired distances. Illumination of a small lamp makes it easy to read the scale. To measure the prominence of the eye, a trial frame is fixed in front of the patient's eyes, by a rubber band around the occiput. The distance of the frame in front of the orbital margin and its distance in front of the apex of the cornea are then measured, to determine the protrusion of the eye. In a later note the apparatus is modified by mounting on the tripod base, with the screen and scale marked thereon attached. See Fig. 5.

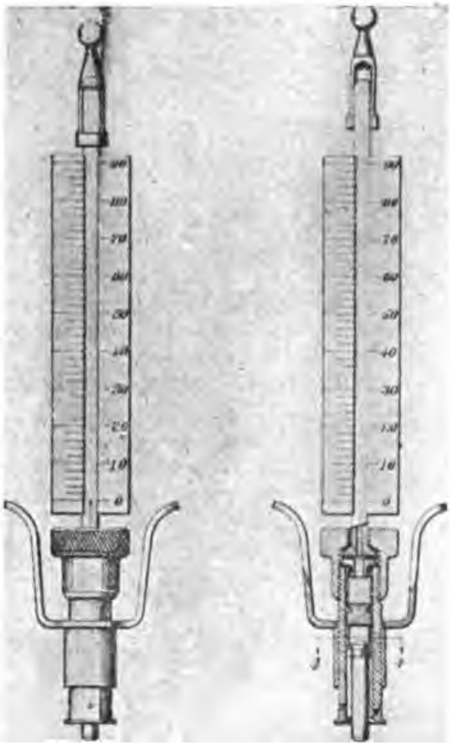

Fig. 6. Mercury tonometer of Cohn. A, General appearance of instrument. B, Cross section showing its construction with rod at bottom pressing upon reservoir of mercury as soon as pressure on the eyeball causes it to rise above line 4-4.

TONOMETRY. A *mercury tonometer* which gives a direct reading of the height of a column of mercury raised by the resistance of the cornea to the weight of the column is described by **Cohen.** It is illustrated in Fig. 6, in which A shows the general appearance of the instrument, and B the construction of it. The area of a cross section of the tube in which the mercury rises bears such a relation to the size of the reservoir, that displacement of 1 mm. in the rod resting on the cornea causes a rise of 90 mm. in the column of mercury. The instrument is applied to the center of the cornea, with the tube of mercury held vertically. Careful comparison of the readings of this instrument, when applied to the enucleated eye, and normal or pathologic eyes in situ, show that its indication correspond closely with those of the Schiötz tonometer.

Bailliart has tested the accuracy of eight tonometers obtained from different sources, by comparison with the manometer readings obtained from the eye of a rabbit. Some of them, made in Christiania before the war, corresponded very closely with the actual intraocular pressure, except as pointed out by Priestley Smith, and later admitted by Schiötz, the readings were always somewhat too low. Other instruments were less accurate. One of then introduced an error of practical importance.

Gjessing reports the results of tonometric measurements of 2,186 eyes with the Schiötz instrument with 5.5 weight. Of these 1,132 were normal, and 1,054 were the eyes of the patients showing some opacity of the lens. He also made special studies on the eyes of eight persons as to the daily variations of tension and the affects of drugs instilled into the eye. He finds that the tension has no relation to the age of the patient or the refraction of the eye, except where the ametropia is excessive. That the two eyes of the same individual are practically alike in tension, and where they differ it is usually by a very small decimal. These results agree with those of previous observers, especially Cridland.

As to the affect of drugs,: Holocain 2% and homatropin 1% produce no change of tension, altho the former in some cases causes disturbances of the corneal epithelium. Cocain in 2% solution caused no change in six persons, and slight temporary diminution of tension in two. In 5% solution there was always a brief decrease of tension. Pilocarpin 2% or eserin salicyat 1/2% caused decrease in tension of three graduations. The tension taken at various times of the day showed very slight variations. The same was true after subcutaneous injection of morphia. During syncope 2 patients showed a decrease to 10 and 14.

Green has reviewed the various forms of tonometers heretofore suggested and the limitations of the instrument as to accuracy and reliability. He describes his method of using the Schiötz-Gradle tonometer; and points out that cooperation of the patient is obtained by avoiding excitement, briefly explaining what is being done, and 3 instillations of 1% holocain solution.

RADIOGRAPHIC DIAGNOSIS. The value of radiograms free from the shadows of the bony walls of the orbit and adjoining parts is urged by **Vogt.** Such pictures can be taken with a soft tube and a relatively short exposure; and they bring out clearly the outlines of the soft tissues, the cornea, lids and eyelashes, and the presence of very small splinters of metal, glass, stone, etc. To obtain such pictures, pieces of film of appropriate size must be wrapped in one or two thicknesses of lead foil, and protected by black paper which should not be too thick. Exposures are made horizontally and vertically. For the former the film is pushed as far as practicable into the orbit at the nasal side of the eyeball, and the tube placed to the temporal side. For the vertical exposure the film is thrust into the inferior cul de sac of the conjunctiva, and the exposure made from the above. In this way a foreign body can be detected almost or quite as far back as the equator of the eyeball; the exact extent of the region that can be thus reached depending on whether the eye is prominent or deep set. Local anesthesia prevents any serious discomfort to the patient, if the edge that is thrust in is rounded and smooth. **Lang** has written on aids to definition in X-ray work.

VISUAL ACUITY. A new ***metric scale*** for measuring the acuteness of vision is proposed by **Dor.** It consists of a series of black circles and black squares on a white ground. For the distance of 10 meters, the black circle has a diameter of 15.7 mm. The black square has a side of 13.9 mm., both having the same area. In the series he presents, the sizes are such as should be distinguished with a visual acuity ranging from 5/5 to 5/100. The person tested of course has to decide whether the figure indicated is a circle or a square. It was devised to meet the problem of testing illiterate soldiers, and is called a "universal optometric scale."

The test figure proposed by **Pacalin** is a series of parallel, black lines on a white ground, with interspaces equal to the width of the lines. These are arranged in groups which vary from 2 to 6 in number. The person examined is required to state how many lines there are in the group indicated. Since "all the world can count," it serves for the testing of illiterates.

Baslini has arranged 12 of Landolt's broken rings, each of which can be made to appear or disappear by pushing an electric button. Uniform illumination is secured by incandescent electric lamps.

The new test card of **Thorington** uses white Gothic letters printed on a black ground. The letters are arranged in lines vertically as well as horizontally, so that they can be read from above downward as well as from either side. Opposite each line is a numeral by which it can be designated. **Oguchi** writes on the distinctness of the various (Karma) letters of the Japanese. He has divided these into groups according to their distinctness, and points out that slight changes in some of them would render them much more distinct. **Löhlein** describes picture test cards for children, and **Cohn** writes on vision tests.

Hegner, after a general discussion of the measurements of visual acuity by letters, suggests photographic reduction of the distance tests for use in testing the near vision. The distance of the letters from the eye is to be taken on a graduated rule. **Cowan** has suggested a test card holder, with a lamp giving uniform illumination, for near vision test cards. It has a graduated tape attached, for measuring the distance of the card from the eye. **Stadtfeldt** discusses tests of vision for aviators. **Steindorff** has written a general review of sight testing, considering the things that influence visual acuity, as refraction and accommodation, and discussing the objective tests, taking the visual fields and judgment of retinal conditions.

Some factors affecting visual acuity are discussed by **Sheard.** These are the differences in readability of different letters, with regard to which he quotes extensively from reports made to the Section on Ophthalmology of of the American Medical Association. They have been noticed in previous volumes (see v. 12 p. 21, v. 13 p. 23, v. 14 p. 4). The influence of age and sex on visual acuity reported by Donders and de Haan does not seem to have been corroborated by later observes. The influence of the diameter of the pupil on visual acuity is related to ametropia and illumination of the test. Each of these has been investigated by several observers, but the two factors are not sufficiently coordinated. The influence of retinal adaptation and intensity of light also have to be considered together. The maximum of acuity for light of different colors also depends on intensity. For practical use, or visual efficiency, sensitiveness of the eyes must be considered in connection with the acuity, the optimum of illumination being different for different eyes.

PERIMETRY. In describing an illuminated perimeter, to which a campimeter field may be attached, **Ferree** and **Rand** point out the factors that produce variable results, as to the limits of the color fields. These are the wave length and purity of the light, its intensity, the visual angle
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Biting fixation is used to preven
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ment screw to move the eye to th
right to bring it into the axis of th
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field be taken approximately with
moving stimulus, and then accuratel
mapped with the stimulus stationary
A campimeter field that can be attached to the instrument includes an angle of 30° in all directions from the point of fixation.

Hudson has described a perimeter in which the arc on one side of the axis has a radius of 33 cm., and on the other side a radius of 100 cm. A slot in the middle of the arc permits the test object to be carried to all parts of the field. At the back of the instrument an indicator moves over a blackboard marked with circles and radii indicating the different parts of the field, upon which a record may be made with chalk to be subsequently transferred to a record blank. The arc is broad enough for the flatter side to serve the practical purpose of a campimeter. (See Fig. 7 and 8.)

The recording scotometer of **Marks** consists of a Bjerrum screen, on which the test object is moved by the arm of a pantagraph, which carries a pencil point to corresponding positions on a record blank, making it a recording campimeter.

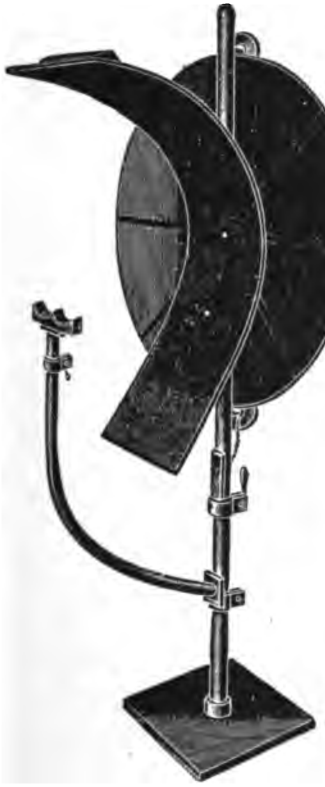

Fig. 7. Hudson's perimeter from front. Arc with sharp curve above, less curve below.

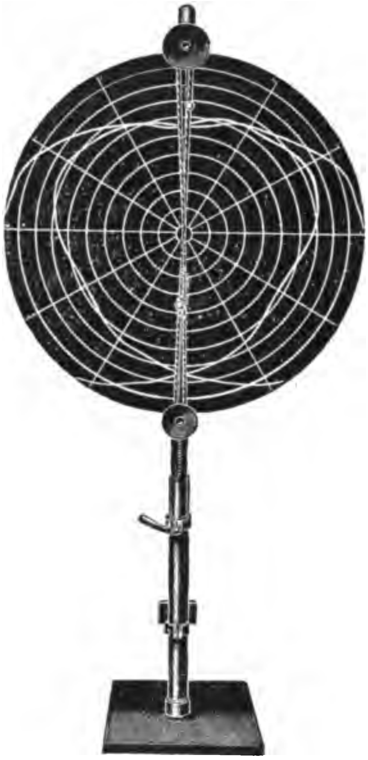

Fig. 8. Back of Hudson's perimeter showing outlines of chart on back of disc, with cords that move the targets.

Lang's article on perimetry compares the usual methods of taking the field with the perimeter arc or a flat screen. The advantages of the latter are that it is less complicated and cheaper. But the fact that it is taken on a tangent plane and not an arc must be considered in making the record. There is a relative decrease in the size of the object as it is moved away from the center of the field, the peripheral field cannot be taken on the plane, the method is slower and more cumbersome, and the surgeon cannot watch as with the perimeter, the patient's eye to see that it is constantly fixed on the proper point. Lang's instrument especially provides for the watching of the patient's eye, and provides for the use of a larger record chart where it is desired to map central scotomata. Complete taking of the fields includes the boundaries for a moving 10° object, the field for a 1° white object, or smaller, and the fields for colors. Care must be taken not to fatigue the patient; if fatigued his attention will wander and inaccurate records will result.

Van Kirk has modified Peter's *campimeter* by making the fixation point more noticeable, and placing the circles, indicating the number of degrees from the center, upon the back of the instrument. For the face he uses black velvet, with a white button at the center for the fixation point. The back is of white muslin, marked with concentric circles and radii. These are stretched on a ring of steel wire. Slight pressure on the screen with a test object shows its position on the back, from which it can be noted upon the appropriate chart.

Walker says elaborate apparatus is not necessary for quantitative perimetry; what are needed are a few yards of dull black cloth and a wire handle with a 1 mm. white spot on the end. This test object should subtend an angle of about 2 minutes to detect the earliest changes in the field.

The position and size of the *blind spot* has been studied by **Eichenberger,** in 92 patients, using the Bjerrum screen at a distance of 2 meters. He finds that the horizontal distance of the center of the blind spot from the point of fixation varies from 14 to 18 degrees. Its vertical diameter averages about 5 1/2 degrees, its horizontal diameter 3 3/4 degrees, making it materially smaller than stated by Van der Hoeve. The height of 5° 28″ corresponds to 1.596 mm. vertical diameter of the optic disc, which agrees with the average of anatomic measurements.

It is suggested by **Lloyd** that in *squint,* outlines of the blind spot and of the peripheral field may be taken for both eyes, with the good eye fixing. Then covering the good eye, the blind spot and the peripheral field can be mapped for the poorer eye by its own fixation. He thinks that a comparison of the two fields may give valuable information throwing light on the treatment of squint and its results.

A relative insensitiveness for red was found by **Simon** in the upper part of the visual field, but no marked scotoma as mentioned by Birch-Hirschfeld. Fifty normal eyes were examined with the scotometer of Priestley Smith and the standard colors of Engelking and Eckstein. The habitual exposure of the lower half of the retina to the light from the sky may lead to slight permanent impairment of its perception of colors. **Kacke** has written a thesis on perimetry pure colors.

Harman's direct scotometer field of grey cloth marked with c and radii and a small white metal for fixation. On the back of screen is placed a sheet of ca paper, and the blank paper on w the chart of the field is to be made. test object is moved by the hand tected by a grey glove. Back of test object is a small style whic pressed against the screen to ma mark on the chart at the boundar the field. Red and blue cop papers permit fields for those color be outlined on the same chart. screen, and knob against which side of the nose is pressed, are ported upon a base, upon which t can be folded so as to occupy very tle room.

For mapping the blind spot paracentral scotomas, **Brown** uses screen made of shade cloth, with fixation point marked near one s and circles indicating the angles c centric with it, of the proper size use at 2 meters. The screen can hung with either edge up, so that can be used for either eye. For a ch he uses paper of appropriate si marked in squares. **Cowan** has su gested that for mapping retinal lesio or the scotomata depending on the the squares in which the chart is la out should bear a definite relation the area of the corresponding lesion the retina. The angle of 1 degree the nodal point of the eye correspon to 1/4 mm. measured on the retin Squares of appropriate size might b superimposed on the usual chart f mapping the results of examination with the perimeter.

The perimeter of **Vincentiis** consist of a double metal ring supported by firm base. Against the fixed half o the ring the patient's face is steadied with the eye directed towards the fixation point over a gunsight. The background consists of a screen, or the wall of a room, of proper uniform color. The movable half of the ring rotates upon the fixed half in its plane, and carries an arm bearing the test object. By the motion of the ring this arm can be placed so that the test object can be moved in any meridian of the visual field, to a distance of 90 degrees from the line of fixation about an axis passing thru the eye tested. The carrier of the test is movable upon the arms, so that it may be placed at any distance up to 120 cm. from the eye to be tested. Tests of various sizes and colors can be used. The ability to place them at different distances furnishes a means of detecting simulation.

DIPLOPIA.—Monocular diplopia or polyopia arises from defects of the refracting surfaces or media. **Jackson** points out our definite knowledge of this form. That which arises from abnormal brain action is less understood, but both kinds deserve careful study.

LIGHT SENSE AND ADAPTATION. An instrument to test the dark adaptation of the eye has been suggested by **Stargardt**. A dark box 107 cm. long, by 25 cm. broad and high, has partitions dividing it into three compartments. Each partition has an opening closed with milk glass, and there is a similar opening in the end of the box opposite the lamp. The openings in the partitions can each be closed by a metal slide. When they are fully open the illumination is diminished to 1/20 by each of them. Partial closure of the metal slide diminishes the light still farther, and in this way it may be reduced from 1/6.5 meter candles to 1/65,000 of one meter candle. This apparatus, simple in principle and construction is reported to give good results corresponding closely with other more elaborate tests.

Bierens de Haan has used the visual acuity by feeble illumination as a test of retinal function and adaptation in myopes. He finds that in myopic eyes the loss of vision by diminished illumination is much more rapid than in emmetropic eyes. **Xilo** describes a method of measuring visual acuity by reducing the illumination of the test. **Chavigny** has written on the simulation of hemeralopia.

GENERAL DIAGNOSIS. A review of proteolytic ferments in ocular disease, as studied by the *Abderhalden method,* is published by **Sunseri**. He found, in the serum of four out of five patients suffering with traumatic cataract, evidence of a ferment specific for lens protein. In one case it was not found. Among 32 nontraumatic cataracts only 11 showed this ferment, and in 3 it had disappeared some weeks after the cataracts were extracted. Of 14 traumatic cataracts in rabbits, 11 were attended with positive reactions. After the cataractous eye had been removed, 5 out of 6 gave negative results. In 20 cases of corneal disease, 5 gave positive reactions, 2 of interstitial keratitis, one recurrent keratites, one hypopyon ulcer and one healed ulcer. With keratitis artificially produced in 5 rabbits, 4 gave a positive reaction, two of them becoming negative after enucleation of the diseased eye. Of 9 cases of choroiditis, 4 gave positive reactions to choroidal protein. Three of these were choroidal ruptures and one luetic. A conjunctival epithelioma showed a positive reaction to conjunctival protein, and a choroidal tumor was positive for the choroid. Further work with regard to tumors is desirable. In other directions the Abderhalden method does not offer much help for practical ocular diagnosis. **Ismael Porto** has written a thesis on the Abderhalden seroreaction, which cites the literature reporting its trial in ocular conditions.

The importance of the ophthalmoscopic examination in cases of brain tumor has been urged by **Baird,** and **Rothschild** pleads for more extended use of the ophthalmoscope by the general practitioner. **Wood** discussing the common errors in ocular diagnosis, lays stress on a detailed history, with each development in chronologic order, a recognition of the superiority of objective over subjective symptoms, and the value of instruments of precision and prolonged observation. **Coghlan** has described the use of the ophthalmoscope in the hope of making it more generally available in general medicine.

Therapeutics

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DENVER.

This section carries the literature from January, 1921, to January, 1922. It deals papers of general character. Specific remedies, like tuberculin or those directed a; syphilis, will be considered in the section on General Diseases. Local measures are sidered in connection with the parts to which they are applied, as carbon dioxid sno trachoma under the heading Conjunctiva. For previous references see Ophthalmic Liter vol. 17, 1921, p. 11.

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DIGEST OF THE LITERATURE.

BIOTHERAPY. The use of *milk* in the treatment of ocular diseases, is still gaining in popularity. A great deal of space in the literature has been devoted to this subject in the past year. **Marin Amat** has treated 300 cases of various eye diseases in this manner, and called this therapeutic measure a miracle. He classifies the various diseases in which he has used milk, and found it to be of the greatest value in ulcus serpens, especially when it is associated with hypopyon. Excellent results were obtained in iritis and iridocyclitis. The infection following operations, subsided rapidly following injections of milk. Marin Amat stated that the treatment is of doubtful value in tuberculosis, tabetic optic atrophy, and in detachment of the retina. The author injects from 3 to 5 c.c. parenterally, and in severe cases, he has given as much as 10 c.c. Numerous reports accompany the article.

Purtscher is an ardent advocate of the parenteral use of milk, and reports a large series of cases in which he has had good results by this method of treatment.

From **Jendralski's** experience and a critical survey of literature, he concludes that parenteral *milk therapy* in ophthalmology has yielded results worthy of consideration, especially in recent gonoblennorrhea, iritis, and some cases of eczematous keratoconjunctivitis. The experience in other eye affections are not sufficiently numerous and uniform to allow of final judgment. Milk as free from bacteria as possible, before sterilization, should be used. Bacterial proteins are undesirable as they increase the reaction following injection. The cases should be carefully selected and closely watched during the treatment, for manifestations of general and local disturbances.

Coppez enthusiastically advocates parenteral injections of milk for the treatment of acute iritis. The author also claims that intraocular hemorrhages of traumatic origin absorb more rapidly after its use. In gonorrheal conjunctivitis, the secretion dimini after milk injections, and local t ment can be more effectually ca out.

Five cases of suppurative kera some due to trauma, were treate **Garcia Mansilla** by injecting steril milk. Following the injection pain diminished, and in all of cases, the hypopyon had lessene the following day. The author sure that the course of the inflam tion had been materially shortene this method of treatment. He em sizes the need of local treatment in dition to the injection of milk.

Fradkine remarks, that in milk have a valuable therapeutic agent, not a panacea for eye diseases. author agrees with Marin Amat, t it is of great value in ulcus serp and should be used regardless of age of the patient. He believes t doses of 2 or 3 c.c. should be gi every day until cicatrization of cornea has taken place. Fradkine lieves that the beneficial action of m can be explained by Erlich's theory immunity; that a passive immunity sults from the injection of alex which are present in the milk, and t an active immunity does not occur stimulation of the organism into t production of natural antibodies. H tories of cases successfully treated this method are reported.

Zimmerman's article on parente *injections of milk* in diseases of the e gives us a review in English of so of the work done in the past on t subject. The author discusses t technic of administration and the va ous theories which have been e pounded to explain its action. T complications which might occur, an the results which follow the injectio of milk, are mentioned. Two case r ports are given, illustrating an i stance with complications, and on without, after milk injections.

Wiese concludes that eye patient occasionally are effectually aided b milk therapy. Milk is also indicate as a support of specific serum therap in obstinate cases of diphtheritic, tuberculous, and luetic ocular affections. Clinical histories, arranged according to different groups of diseases, are reported to illustrate successes and failures.

Schmidt increased the effect of milk injections by instilling dionin into the eyes. He recommends dionin on the day of the first injection.

Holler is skeptical about classifying milk injections as a protein therapy. He calls our attention to the fact that milk is a complex chemical mixture, made up of proteins, fats, inorganic salts, etc., not a pure albumin. The author obtained good results during the war, by injections of common salt, in the treatment of ocular inflammation and thinks that milk might act in a similar manner. Holler's experience leads him to believe that *Deutero albumins* "Merck" is more reliable than milk, because it is a mixture of albumins, while milk is an extremely diverse compound, usually contaminated by bacteria and their products. Anaphylaxis is a danger in all types of protein therapy, and the author warns us of this possibility in the use of milk and similar products.

Schwartz reports, in detail, the clinical histories of 8 cases of severe purulent corneal ulcers, 3 cases of infected perforating injury of the globe, and 2 cases of diphtheritic conjunctivitis, treated with milk, or aolan (a milk solution, which does not contain toxic constituents). In all cases a decided improvement of the subjective symptoms, especially the violent pain, was observed 6 to 8 hours after injection. The author concludes that milk injections are a powerful remedy in severe infections of the eye.

Argañaraz reported favorably results with milk injections, in a case of panophthalmitis and in orbital cellulitis; and **Blatt** was impressed with the analgesic effect in his cases of corneal ulcer. **Jocqs** and **Dufau** reported that the cases of ulcer of the cornea with hypopyon, following milk injections, and 3 similar cases which **Marquez** treated, improved rapidly after each injection. **Jocqs**, in his review of the literature on milk injection for therapeutic purposes, noted that Blandel and Robin were the first to use it to combat ocular disorders in 1903, and preceded Müller and Thanner, who first called attention to the value of milk in 1916. (O.Y.B. v. 14, p. 7.)

Rohmer obtained as good results as are reported, following milk injections, by employing *autosero therapy*. The indications for its use are the same as those mentioned for milk. The technic, as described by the author, is as follows: Produce a vesicle 4 or 5 cm. in diameter on the arm, with a fly blister. After 8 or 10 hours, withdraw the serum into a sterile hypodermic syringe, and inject 1 c.c. of the fluid subconjunctivally, after anesthetizing the eye with cocain. Repeat every 48 hours until a cure is effected. **Cassimatis, Filbry, Becker** and **Hassel** write on the therapeutic value of milk injections in ocular diseases.

Key presented a thesis on *paraspecific therapy* in severe eye infections. The author reviews the progress made in this branch of ocular therapeutics and quotes the statements made by various noted ophthalmologists, on the value of this form of treatment. Key believes that paraspecific therapy has a wide field of usefulness, and refers to 44 cases which he has treated by this method. He concludes that diphtheritic serum can be depended on when the case is seen early. Where the disease is advanced, and cautery or curettment of the ulcer is indicated, early relief of pain, and diminished reaction, follows the injection of serum and improvement in the cornea, and early cicatrization takes place. Its prophylactic value, if any, can not be fairly judged by previous experiments or clinical observations, and more work must be done in this direction.

Gonzalez wrote on the action of *tuberculin*. He described the various kinds of tuberculin and discusses the dose and relative merits of each. The use of tuberculin as a diagnostic and therapeutic agent was also considered. **Boing** writes on experiments with vaccine treatment.

RADIOTHERAPY. **Jendralski** reported his experience with radium and X-ray in the treatment of 7 cases of glioma of the retina. In 5 of the cases, this treatment prolonged life by retarding the rapidity of growth of the tumor cells. Two of the cases were apparently cured. One had been observed for two and a quarter years, and the other for several months. When secondary glaucoma existed, pressure was materially diminished after exposure of the eye to radium. The author used 50 mg. doses of radium with three hour exposures, in his successful cases. **Japiot** and **Bussy** give a simplified technic for ocular radiotherapy.

LIGHT THERAPY. **Lundsgaard** reports his experience with the *universal light bath.* He studied the effect on 200 patients, which he had seen in the last three years in the Finsen's Light Institute at Copenhagen. Some of the cases had lupus with ocular complications. The author found phlyctenular keratoconjunctivitis to be uninfluenced by the treatment. The only visible effect of the light bath was rapid and intense vascularization of the cornea, but without favorable result. Lundsgaard considers nodular tuberculous keratitis not adapted for this form of treatment, and the few cases of scleritis treated showed a doubtful result. In affections of the tear sac, the treatment was negative, but tuberculosis of the tear sac in two patients healed very rapidly after opening and curretting. Hence, Lundsgaard concludes that the universal light bath will be effectual if the tear sac is open, either after spontaneous perforation or operation. Tuberculous iridocyclitis was favorably influenced, especially the nodules of the iris, but the treatment must start early. He concludes that the universal light bath is not of great importance in treatment of tuberculous eyes.

Koeppe employed the *Finsen rays* and the *arc lamp* in the treatment of a number of eye conditions, and found them of greatest value in *tuberculosis.* To absorb the heat of rays, he used a solution of equal parts of 5% alum and 5% sulphat or chlorid of iron, as a filter. In treating the anterior segment of the eye, the more inten irritating rays were eliminat filtering thru a solution consist gentian violet 1/1000 and a 15% tion of acetat of copper. Koepp cludes that light therapy is indic lupus and other tuberculous con of the eye, in torpid superficial i tions of the cornea, serpiginous of the cornea, and in trachoma, other therapeutic measures have to give relief. Light therapy is c indicated in anesthesia of the acute catarrhal conditions, an renchymatous keratitis.

Shiodzi experimented on the different animals with *ultraviole* rays (iron arc light and Adam-H quartz spectrograph). He conc 1. Resorption of rays by the and lens differs with various a (previously no difference had b cepted). 2. The capsule of th shows no resorption, while the does. 3. The aqueous and the v humor show absorption of r There is no absorption by the While experimenting with ultr rays, **Keiner** noted a severe r in the conjunctiva and cornea, mentation of the iris, and loc necrosis. He found no change lens, ciliary body, or retina.

Gros calls attention to the fa the stain of fluorescein is not with ordinary artificial light, b of the presence of complim colors. This can be overcome b ing the light thru blue grass which, stained corneal abrasio pear brilliant reddish violet. Th cet contains a short review effect of ultraviolet rays on the e **Waubke** wrote on the ther value of light.

HEAT AND COLD. **Shahan** monstrated his *electric thermoph* **Patton** reported a number of c corneal disease, especially deep i tions, in which he had good after using the thermophore b 150-155° F. for one minute.

Netto writes that heat is of v affections of the anterior segm the eye and is contraindicated dus diseases. **Toyoda** thinks, w current strength and time of application fixed, the influence of *diathermia* upon the aqueous humor increases up to two hours after the current has been turned off, after which its diminution follows until the condition returns slowly to normal. 2. The influence of the current on the aqueous humor rises with the current strength and with the time of heating. 3. The ocular pressure rises in general with the heating. 4. The physiologic action of the high frequency current depends upon the action of the heat, and also upon the deeper penetration of the current. 5. In human beings the influence of the current is in general less than in rabbits, but the effects take a similar course. 6. As a usual symptom one observes a slight hyperemia of the conjunctiva and corneal injection, occasionally a slight degree of chemosis probably with hyperemia of the iris and ciliary body, but no special injury is to be seen.

MASSAGE. **Würdemann** massages the eyeball in the treatment of embolism of the central retinal artery, glaucoma, optic nerve atropy, retinitis proliferans, and to break up iritic synechiae. He has replaced digital pressure by instrumental massage with a pumping apparatus, which alternately sucks the eyeball into a cup and releases it. The rapidity of vibrations varies from 30 to 600 a minute. The eye is treated for half a minute and then inspected; if hemorrhage has not occurred into the anterior chamber, the treatment is continued for another minute.

With the left thumb pressing backward and downward at the upper tarsal margin of the upper eyelid, and the right thumb exerting pressure upward and backward at the lower tarsal margin of the lower lid, the tarsal portions of the lids are averted and made to override, so that pressure may be applied to both. **Selz** massages the lids in this manner in the treatment of chronic congestion of the eye lids (red lids), blepharitis marginalis, and chronic blepharoconjunctivitis with marked thickening of the lids. This author states infiltration diminishes, and congestion disappears, and in blepharitis marginalis ulcerosa, the ulcers heal, and the lashes grow. Combined with the *massage,* Selz frequently uses 1% ichthyol ointment or 1-5% yellow oxid ointment. Follicular conjunctivitis was benefited by message. In trachoma, when an ointment of 1-2000 copper sulphat and copper citrat 1%, was used in addition, marked improvement was noted. Selz massages the lids for three minutes daily for one and a half weeks, then every other day, and later twice each week.

IONTHERAPY. **Schnyder** believes that iontophoresis is of value in inflammations of the conjunctiva and cornea, in dacryocystitis, spasmodic entropion, and other conditions. His best results were obtained with chlor-iodin and zinc solutions.

Erlanger claims that iontophoresis thins corneal nebulae. He uses a chlor-iodin solution made up of sodium chlorid 1% and potassium iodid 0.5%, with the positive pole over the area to be treated. An application of 2 ma. is made for two minutes at intervals of six or eight hours. Erlanger thinks that other conditions of the cornea and conjunctiva are favorably influenced by this treatment.

Birkhäuser reviews the literature on iontophoresis and reports the results of his experimental cases. Out of 10 cases with corneal scars, 9 were improved by treatments of 2 ma. for 2 minutes, with chlor-iodin. The author remarks that patience and persistence are necessary, but that results are gratifying and worth the effort.

In **Albrich's** hands, iontophoresis was found to be of value in infected corneal ulcers. He reports many cases of neuropathic keratitis, which were healed in a few days, and 4 cases of parenchymatous keratitis, which were benefitted by this form of therapy. The author claims the reason that corneal scars have not improved in the hands of some men when treating by iontophoresis is because those treated were not carried over a sufficiently long period of time. Albrich also speaks favorably of this treatment for trachoma in conjunction with other local remedies. Two cases which he saw with Parinaud's conjunctivitis, were cured in two weeks.

OINTMENTS. Vaselin is a poor base for ophthalmic ointments, because it is not absorbed. For this reason, **Coppez** advocates the use of lanolin which contains a high cholesterin content and is absorbed by the conjunctiva.

SUBCONJUNCTIVAL INJECTIONS. **Fuchs** injects 1 c.c. of 10% sodium chlorid solution subconjunctivally, after anesthetizing the conjunctiva with cocain in the treatment of some eye diseases. For hypopyon ulcer and infection of the globe following operations or trauma, **Cousin** uses cyanid of mercury 1/5,000 dissolved in a 2% solution of novocain. He injects 1 c.c. of this mixture subconjunctivally every second day for three injections. The author's results have been satisfactory in 80% of his cases.

Kleefeld writes that subconjunctival injections of glycerinated extract of testicle induce the resorption of exudates such as fine, dust like vitreous hemorrhages. One injection a day for 3 to 5 days is given, and the treatment repeated after a month's intermission.

Campbell anesthetizes the eye with several instillations of 4% cocain before making subconjunctival injections. He adds cocain in the strength of 1.5% or procain 2% to the solution to be injected. The author claims that by this method, the injection is painless. **Villoria** urges the value of subconjunctival injections.

MYDRIATICS AND MYOTICS. A review of the literature on ***atropin*** in ophthalmology, was published by **Frenkel.** Two graphic charts are given; one representing the number of papers published each year on this subject, and the other contrasting the years in which favorable and unfavorable publications were written on the value of the drug. The author then discusses the indications and contraindications for the use of atropin. Frenkel places deep seated affections of the cornea, inflammation of the iris and ciliary body, as the important indication, and glaucoma and superficial corneal conditions, as contraindications to the use of atropin. In the latter conditions, eserin gives better results. In scleritis and scleritis, the author s that atropin is subordinate in it tion, unless iridocyclitis or cyclit present. Its value in strabismus a adjunct to orthophoric treatment i questioned.

Ehrenreich and **Riesenfeld** inst one drop of 1:1,000 solution of atr in the eyes of thirty-six infants, r ing a total of 300 instillations. effect did not differ materially f that in adults. The limit for imm izing the pupils seemed to be 0.001 of the atropin, for inducing mydri 0.00008 mg.

Gassul saw a boy 6 years of age v *belladonna poisoning.* The drug been taken internally. When the c was first seen, there was a posi mydriasis with absence of pupill light reaction and paralysis of acc modation. The patient recovered a the drug was discontinued.

Lotrupp-Anderson wrote on idiosnycrasy to atropin.

Tiffeneau writes that the effect *levohyoscyamin,* the principle alkaloid belladonna, is twice as active as at pin, which is composed of equal pa of dextrohyoscyamin and levohyosc amin. Levohyoscyamin sulphat c therefore be used as a substitute f double the amount of atropin sulph

Guist explains the uncertainty ***homatropin*** as a mydriatic, in sor persons, on the absence of iris cryp This, the author states, is more cor mon in brown eyes. Absence of cryp can not prevent the absorption atropin; but may in many cases, pr vent the absorption of homatropi Out of 9,500 patients, Guist found 2 whose accommodation and pupils wer uninfluenced by homatropin, but wer paralyzed with atropin. In confirma tion of his theory, the author cites cases of heterochromia in which th blue iris was easily paralyzed by hom atropin, while the brown iris was no influenced.

Struben saw a case of *stramoniun* poisoning. The patient had hallucinations with paralysis of the iris for three days.

ANTISEPTICS. After investigating the cation of *argyrol* on staphylococci, **Lancaster** is convinced that it is a powerful antiseptic; it is effective as weak as 1% or even less. It also has bactericidal power, especially in strengths of 10% or over, but is is not a rapid bactericide.

Henderson showed a case of marked argyrosis of both palpebral and bulbar conjunctivae of both eyes, in a man who had been treated with *protargol.*

Ravdin believes that 1% solution of *mercurochrom 220* is as germicidal as a 25% solution of argyrol.

Holloway pointed out that *mercurophen* had a higher bactericidal power than other similar agents. It is two hundred times more active than bichlorid. In his hands, mercurophen appeared to be more active than mercurochrom. Mercurophen is used in the strength of 1-8000 as an irrigating fluid.

After using *acriflavin* 1-500 in 40 cases of trachoma, **Ganguli** noted that the period of treatment was appreciably shortened. If started in the beginning of the disease, complications were prevented. Complications, when present at the time that treatment was instituted, were quickly brought under control, and progress was retarded. When treating trachoma, the eyes were first washed with a solution containing 1/2 grain of potassium permanganat to a pint of water; the conjunctival surface of the upper and lower lids were then rubbed together for about a minute, and the 1-500 acriflavin instilled into the eye.

Loehlein carried out a series of elaborate researches over a period of ten years, to determine the therapeutic value of *anilin dyes* in ophthalmology. He found that Bengal rose 1-25, acriflavin 1-200, and Victoria gold 1-200, were effective pneumococcicides; that brilliant green 1-1000, methyl violet 1-1000, safrinin 1-500, magdal red 1-500, toluidin blue 1-500, were effective in combating the diplobacillus of Morax-Axenfeld, the staphylococcus, streptococcus, and xerosis bacillus; brilliant green 1-5000, gentian violet 1-200, Hoffman violet 1-200, iodgreen 1-400, malachit green 1-600, methylen blue 1-100 and methyl violet 1-200 were gonococcicides. The dyes were applied either topically or in ointment form once or twice daily.

Myashita discussed the action of *remijin* on pneumococci. The drug was obtained a few years ago by Professor Takassashi, from the indigenous plant *Remijia pedunculata.* It is claimed to be chemically identical with optochin and is used in Japan for combating pneumococcic affections. The author studied the effect of an aqueous solution of remijin hydrochlorid on pneumococci. He found that remijin and optochin in the same concentration, had a like effect upon pneumococci. In Japanese mice, the subcutaneously injected solution of remijin, acted as a safeguard against pneumococci. In experimental infection of the cornea of the rabbit with pneumococci, a solution of remijin hydrochlorid had as effective bactericidal properties clinically as in vitro.

Goldschmidt tested the effect of *optochin* on the proteolitic enzymes and found that when it was used in sufficient concentration, it prevented their acting.

Gradle called attention to the value of several drugs, which are not commonly used in ophtholmology. Resorcin 2% combined with percipitated sulphur in ointment form, is useful in treating ulcerative blepharitis. In 2% aqueous solution, it is an astringent and valuable in the treatment of low grade conjunctival inflammations. Mizin is more active than zinc sulphat in combating the Morax-Axenfeld bacillus, and fluorescein of zinc can be supplied in powder form in treating diplobacillary affections. Mercurophen and mercurochrome are mentioned. He emphasizes the value of holocain in neurotrophic ulcers. Butyn—the new local anesthetic—is less toxic than cocain, penetrates the tissues deeply, and does not interfere with the nutrition of the corneal epithelium or elevate intraocular tension.

MISCELLANEOUS. In an experimental study of the action of *sodium glycocholat,* **Yamada** found that one or two drops of the 5% solution of sodium glycocholat applied to the conjunctiva, produced irritation, hyperemia, and edema, and on the cornea, changes in the epithelium occurred. Following subconjunctival injections, edema, hyperemia, and an infiltration of cells near the vessels resulted. With retrobulbar injection, chemosis, hemorrhage, and infiltration of white blood corpuscles, were noted. An infiltration of cells in the parenchyma of the cornea, was also observed. In the iris and ciliary body, edema and enlargement of the vessels occurred. No changes were seen in the choroid, retina or optic nerve. Injecting into the anterior chamber produced an extended inflammation of the cornea and intraocular structures. In injecting into the vitreous, similar changes occurred.

Moreau saw a case in which *emetin* had accidentally entered the eye. No effect was noticed for 10 or 12 hours, but after this period had passed, severe pain in the eye was complained of. This soon became violent, and the patient had a facial expression of extreme distress. The pain subsided slowly and did not disappear for several days.

Viramontes discussed the use of *cocain,* its derivatives, and allied products. **Boussi** writes on the value of dionin in ocular therapeutics. **Leoz** injects *strychnin* in the temporal region in paralysis of the eye muscles. **Nakamura** and **Mukai** have studied the influence of the intravenous injection of drugs upon the aqueous humor.

Butler saw a case with severe reaction following an application of linseed poultice to the eyes. He also reports cases showing an idiosyncrasy for other drugs. The specific and nonspecific remedies in common use in ophthalmology, are reviewed by **Igersheimer.** **Blackburn** wrote on the value of homeopathic remedies in ocular diseases.

Chenisse, in a review of the effect of *ethylhydrocuprein,* when used in the treatment of pneumococcic pneumonia, calls attention to the great danger of amblyopia, which frequently follows its administration.

In an editorial on "Over Tre
Jackson points out the dange
plying irritating drugs too fre
or their use for over too long
of time. The too zealous use
may aggravate the condition
plicate it. This fact is often ov
by the conscientious physician,
his efforts to effect a rapid cu
his desire to do all that can
treats the patient with too muc
The author illustrates his poin
ing the local irritation set up
pin, silver nitrat, dionin, et
states that any drug which ca
ence the vital processes for go
also do harm if injudiciously

Pick reported a case of blin
a child, caused by a nurse instil
wrong drops. **Darier** publishe
of 727 pages on general and
therapeutics. The volume is
with the exception of the me
radium in vernal conjunctivi
some more recent drugs an
peutic measures, which hav
published since the book went

Seto carried out extensive re
on the transmission of *urotro*
the anterior chamber of the
the formation of formaldehy
found that the albumin in the
chamber and the tears c
enough urotropin to cause preci
when treated with colloidal io
tropin, if injected into the a
veins of rabbits, reaches the
chamber immediately, and is
strongest concentration in the
thirty minutes. In the tears w
secreted, it makes its appeara
hours after the injection. F
hyd does not exist in the aqu
mor in a demonstrable conce
in all cases. To demonstrate
tericidal influence of the aqu
mor containing urotropin, it w
with media containing virule
mococci and placed in a test t
thirty minutes to an hour, and
into the abdomen of mice, wi
tive results.

Imamikol is an antisyphilitic
tion, produced in Japan. It
27.5% of mercury. With th

Hayashi has seen very good results in syphilitic ocular manifestations.

In treating exudative eye diseases, **Lauber** has injected 40 c.c. of a 25% *sugar solution intravenously*. He reports cases of neuroretinitis with advanced arteriosclerosis, rheumatic iritis, and chronic tuberculous iridocyclitis, which were benefited by this treatment. The theory of its action is not stated.

Leo thinks *calcium* salts are of value in ophthalmology. He uses calcium chlorid by mouth and occasionally injects it subconjunctivally. When administering it by mouth, one must be cautious because of the danger of gastric irritation. **Fisher** recommends *rest* in heterophoria, claiming that relaxation of the muscles is beneficial. **Dowling** reports three cases of intraocular hemorrhage associated with high blood pressure. This condition was relieved by venesection.

Jackson states that the greatest success is attained in ocular therapeutics by careful attention to details. The essayist illustrates by examples of success and failure because of the mastery or neglect of essential factors. He remarks that the eye is a small organ at most, and that one who takes it as his especial field, should realize the importance of small things. **Nordenson** has written on facilities for treating eye disease.

Operations

John A. McCaw, M.D., Oph.D.

DENVER.

This section reviews the literature of 1921. Only general operative procedu
reviewed. All particular operations will be found under the headings of the port
the eye on which they are practiced, or in connection with the diseases which
them necessary. For previous literature see Ophthalmic Literature, 1921, v. 17,

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DIGEST OF THE LITERATURE.

DISINFECTION. — **Würdemann's** editorial on surgical asepsis in ophthalmic operations is a plea for better surgical asepsis on the part of ophthalmic surgeons. He calls attention to the danger of dust and scales falling from the head of the operator or his assistants, or the danger from expired breath containing droplets of water mixed with mucus and microorganisms. Then too, every time we open our mouths to talk actual drops of saliva may be expelled with force for several feet, and saliva is certainly not clean. His plea is for caps to cover the head, and masks to cover the nose and mouth.

Bell's paper is a presentation of a method to prevent postoperative intraocular infection and includes his results in 400 operations on the eye. The first step in his technic is to take care of any focal infections, especially in teeth or tonsils, and intestinal toxemias. All this work on focal infections must be done from two to three months before the patient is admitted to the hospital. A Wassermann is made in zonular and complicated cataracts, also in hard cataracts when necessary. The urine is examined several times previous to the operation. The patient is admitted to the hospital. Twenty-four hours before the operation, a dose of castor oil is given.

Two hours before operation, a smear of the conjunctival sac is taken, after which two drops of 1 per cent. silver nitrat solution are instilled into each eye. When the patient comes to the operating table, the eyes are washed out with a normal salt solution as a means of freeing the operative field of mucus, dust, etc. He trys always to get a conjunctival flap. After the operation he employs two drops of a three per cent. atropin solution and 25% argyrol solution, after which both eyes are bandaged for forty-eight hours. Then every two days the eye is dressed and argyrol and atropin instilled. Bell's paper includes a table that gives the number of cases, the diagnosis, the laboratory report on the smear and the operation, and concludes with a summary.

Discussing the above, Lambert had tried Bell's method in 200 operations without a single infection. Donovan expressed himself as a bit skeptical of this method. He has used an ointment of red mercuric iodid, strength 1-5000, (now he has increased its strength to 1-1000) mixed with a little potassium iodid dissolved in water, then incorporated in anhydrous wool fat and finally adding the petrolatum.

Verhoeff thought it was difficult to draw definite conclusions in regard to infection because it occurs so seldom. For five years he has employed the following method. The only preparation of the patients eye before operation is to cut his eyelashes. At the time of operation the first procedure is to paint the skin with 2 per cent. tr. iodin. The whole face is painted, and special attention is given to rubbing the iodin into the eyelashes and lid margins. The patient's mouth and nose are covered with a gauze mask, similar to that used by surgeons. Then he tries to sterilize the conjunctiva by using a 4 per cent. solution of protargol.

Elschnig has proved that in the majority of cases the conjunctival sac contains pathogenic organisms. These organisms ought to be eliminated before operations can safely be performed, and Bernheimer in his published work has shown the value of this prophylaxis by reducing his losses to 0.25 per cent. Elschnig lost only 25 eyes from postoperative infection in over 1,500 operations, and this includes not only eyes enucleated, but those so severely damaged as to be useless. Elschnig used a mixture of two parts of nutrient broth with one of sterile blood serum; a few drops of this mixture are drawn up in a sterile pipette, these are now blown into the conjunctival sac and well smeared about the sac with the end of the pipette, the liquid is drawn up again with the pipette and dropped back into the tube. The tube together with a similar uninoculated tube is incubated for from 24 to 48 hours. If at the end of 24 hours the broth shows a diffuse clouding, the presence of streptococci is almost certain. A crumby clouding indicates the xerosis bacillus. Smears are stained by Gram's method and by methylen blue. Methylen blue gives all the differentiation that is necessary. If the tube remains clear, the absence of organisms likely to cause trouble can be assumed.

For three days before operation, yellow ointment 2% applied to the conjunctiva and borders of the lids once a day, and the eye covered with gauze and Fuchs' mask is the plan of **Betti,** who lays especial stress on the most careful preparation of the salve to avoid irritation. His formula is: Hydrarg. oxid. flav. 0.20. aq. destil. 1.00, lanolinae anhydricae 2.00, vaselin. This procedure renders the normal conjunctiva and lid borders sterile in 2 days. The results at the clinic proved its efficiency.

For the sterilization of thread sutures, **Reitsch** used the metal case of Pfluegk, but in addition used a wide strip of large mesh linen, 10 cm. by 30 cm. long; at one end he stitched a rod of metal or glass or wood. The sutures were threaded and the needles put under this rod, and the sutures were stretched out on the linen mesh. At the other end another rod was sewed in, and with the second rod as a pivot the mesh was rolled up and placed in the sterilizer and sterilized ready for use.

ANESTHESIA. — **Handmann** inj from 0.2 to 0.3 c.cm. of eusemi first, then 2% novocain and sup nin after instillation of 5% cocain, very good results in 238 intrab operations, of which 76 were cat extractions, not counting num perforating injuries.

The report of the Committee o cal Anesthetics in Ophthalmic appointed by the ophthalmic secti the American Medical Associati study the subject of local anest in ophthalmic practice, draws thes ductions.

1. A survey of the acquired e ence of representative ophthal gists. 2. Clinical investigation. 3 perimental investigation on anima Analysis of the literature. After carefully covering these four fiel study, they conclude as follows:

1. For surface anesthesia, coca 4 per cent. solution, freshly made sesses distinct advantages ove other local anesthetics, particular operative work. Concerning c anesthesia, the following is offer

(a) In all instances the anes is equal to, and in most cases greater than, that produced by other local anesthetic.

(b) Its toxicity, when used i small dosage required for ocular thesia, is almost negligible and not count as a serious objection

(c) The desiccation and distur of nutrition of the cornea produc it are negligible or entirely av if care is observed in keeping th lids closed after the instillations cocain solution, and up to the tim the operative work is to begin.

(d) The dilatation produced b cocain is of short duration, doe often occasion inconvenience, an be overcome promptly by the c effect of a weak miotic.

(e) The penetrating effect of solution is increased by the addit 0.5 per cent. solution of sodium bonat.

(f) The efficiency of cocain so is not impaired by boiling.

(g) The efficiency of cocain tions is not effected either as to sity or prolongation of anesthesia by the addition of epinephrin.

(h) The use of stronger solutions than the one recommended are at the risk of seriously disturbing the nutrition of the cornea and interfering with the healing process.

2. Phenacain in 2 per cent. solution stands next to cocain in efficiency. Concerning phenacain anesthesia, the following is offered:

(a) It has the advantage of producing a quicker effect than cocain and a slight antiseptic action.

(b) It does not dilate the pupil, hence is valuable in producing surface anesthesia for tonometry, therapeusis and removal of foreign bodies from the cornea.

(c) It does not produce desiccation of the cornea; nor, so far as known disturb nutrition.

(d) The solutions are not effected by boiling.

(e) Epinephrin does not add to its efficiency.

(f) Alkalies should not be added to phenacain solutions, as they cause precipitation.

(g) Phenacain offers the distinct disadvantage of producing more or less irritation, which is very objectionable to sensitive patients.

(h) Phenacain is incompatible with alkalies and their carbonate bases, and the use of glass vessels should be avoided in preparing the solution, porcelain being used instead.

3. Procain in 2 per cent. solution is the anesthetic of choice for infiltration anesthesia.

(a) The addition of epinephrin does not increase efficiency, but does delay absorption and diminish the chances of accidental poisoning.

(b) Procain solutions should be injected slowly to aid in the avoidance of toxic effects.

(c) The efficiency of procain solutions is not increased by the addition of alkalies.

Gradle compared cocain, holocain and the new synthetic anesthetic with the trade name of Butyn, as to rapidity of action, toxicity, duration of anesthesia and the amount required to produce anesthesia. Also he employed the drug for the removal of foreign bodies, opening and curetting chalazion, the treatment of lacrimal passages and in tonometry. His conclusions are:

1. The anesthetic effect of Butyn is about twice as rapid as cocain in solutions of equal concentration. 2. The toxicity of the two drugs is about equal, but less of Butyn is required to produce effect than of the natural alkaloid. 3. Butyn does not dilate the pupil or influence accommodation and cocain does. 4. Butyn has no effect upon the intraocular tension and cocain may have. 5. There is no drying of the corneal epithelium following the use of the synthetic preparation, as there is apt to be following the use of cocain.

Sherwood-Dunn's book on Regional Anesthesia is an exceptionally complete presentation of infiltration anesthesia. His method, which follows that of Reclus, Pauchet, Sourdat and Laboure, combines infiltration of the skin and subdermal tissues with nerve blocking and is said to be available in 80 per cent. of all surgical procedures.

The medicaments used are as follows:

(1) 25 drops of 1-1000 adrenin solution to 200 mgms. of 1/2% procain solution. (2) 25 drops of adrenin to 100 mgms. of 1% procain. (3) 25 drops of adrenin to 50 mgms. of 2% procain. (4) 25 drops of adrenin to 25 mgms. of 4% Procain. The 4% is used but seldom for the blocking of the cranial nerves and brachial plexus. The 2% solution is used frequently, as a rule for the nerve trunks; but the 1% and especially the 1/2% solutions are those most commonly employed, the latter for infiltrations.

Anesthesia obtained by nerve blocking lasts from 1 1/2 hours to 2 1/2 hours. It is usually complete but if necessary a few inhalations of ethyl chlorid may be given. Morphin-scopolamin administered hypodermatically assists the general analgesia and makes a quiet patient. Special training is required before the method can be used successfully, but skill may be acquired in a few hours' study. Special syringes are needed with needles of various sizes and lengths.

Danis reviews the anatomic distribution of the nerves of the eye and its adnexae. Anesthesia of the nerve trunk supplying the part to be operated on is preferable to infiltration into the region itself. In most cases anesthesia of the terminal branches is sufficient. In enucleation, after anesthetizing the conjunctiva by instillation, perineural injection is made of the ciliary ganglion and the anastomotic branch of the superior maxillary and the lacrimal nerve, and finally injection of the infraorbital nerve. In extirpation of the lacrimal sac, injection of the nasal nerve and of the infraorbital nerve give excellent results. A crown injection around the orbit is best for operations on the upper eyelid. For operations on the external three-fourths of the lower lid, anesthesia of the suborbital is sufficient, but for operation on the internal one-fourth, the nasal nerve should also be injected. He considers novocain with adrenin the best anesthetic for most purposes.

Lemoine and **Valois** describe a new method of procedure for anesthesia of the infraorbital nerve. The method is based upon the fact that the internal border of the frontomalar suture, the infraorbital foramen and that part of the alveolar border comprised between the two first incisors are on the same straight line. The portion of the alveolar border situated between the first and second incisors is plainly visible. The internal border of the frontomalar suture is determined by digital exploration of the bony circumference of the orbit: The swelling, more or less noticeable, that the orbital process of the frontal makes is easily felt, then a little lower the finger feels a little depression of which the deepest part corresponds to the frontomalar suture. It is easy to indicate this landmark on the skin with a stroke of tr. iodin or anilin pencil. The point thus determined is situated about 4 mm. above the horizontal line passing thru the external angle of the palpebral slit. After painting with tr. iodin the needle is inserted in the gingivolabial furrow in
a direction following the landmark
mapped out. The needle glides ov
the periosteum and penetrates t
canal when a slight lateral moveme
will permit the assurance that it is
the proper position.

Fuchs reports fifty eye enucleatio
under Seidel's infiltration anesthes
For the preliminary injection in the
cases reported, a 1% novocain is u
with 5 drops of adrenalin per 10
added; 1/2 c.c. of this solution is
jected under the conjunctiva at f
points, on the upper, lower, nasal
temporal sides. According to Seid
technic, the principal injection is m
5 minutes later. Fuchs extends
interval to 8 minutes. For this in
tion, 2 c.c. of the same solution is
jected into the orbit at four point
before. The average interval betw
the final injection and operation in
author's cases was 22 minutes, var
from 7 to 42 minutes. The operat
lasted from 3 to 13 minutes, an
age of 8 minutes, being in all
painless. In only 4 cases was
any serious bleeding, which was
trolled by compression and su
Eight patients complained of
operative pain in the wound; in
cases this was severe.

The method of Vogt in the eye
at Basel is reported by **Luessi.**
or a whole ampoule containing 1
of a 1% solution of cocain with
tion of adrenalin are, before a ca
operation, injected at the uppe
lateral limbus, after 2 previous in
tions of 5% cocain at an interv
to 3 minutes. In glaucoma,
solution from 2% to 5% is used.
a minute's irrigation with oxy
solution 1/3%, and after anothe
ute's waiting, the resulting ed
removed from the limbus by s
it with a spatula toward the per
The advantages lie in the a
anesthesia and the exclusion of
fensive movements of the
which gives a much better o
prognosis. The best proof is fu
by cataract operations. If ne
the mydriatic action of cocain i
teracted by previous instilla
pilocarpin or eserin. Slight

rhages under the conjunctiva were of no account, and hyphema occurred in 25%, i. e., not more than in the cases operated on without subconjunctival injections. 343 operations, with this method, are given in tabular form.

In order to avoid the disturbing reflex motions, not dependent upon painful sensations during eye operations, as obstinate contraction of the lids and moving the eyeball upwards, which occur even in complete anesthesia, **Rochat** devised artificial paralysis of the motor path. One c.cm. of the 2% novocain solution with adrenalin is injected 1 cm. behind the point of intersection of the vertical tangent at the lateral margin of the orbit, and the horizontal tangent at the inferior margin, along them to the bone. Likewise injections may be made into the superior rectus. There were no ill after effects. Rochat also found that the anesthesia of the iris, which after cocain instillations often is insufficient, became more complete.

Kraupa discusses poisoning, manifested by epileptic convulsions, following the use of novocain employed in anesthesia of the orbit in operations for excision of the eyeball, and thinks it is referable to injections of a vein. The possibility of injection of the optic nerve sheath, with consequent direct influence upon the brain, should not be lost sight of. Such cases should be considered as unfortunate. accidents, and not as instances of genuine epilepsy.

Barton has discussed the behavior of the eye in connection with the administration of general anesthetics.

INSTRUMENTS. **Bennett** describes a knife for performing *posterior sclerotomy.* The instrument is bayonet shaped and hollow ground, which at 10 mm. from the point makes a triangular wound, each side of which is 2 mm. in length. He considers his instrument superior to the Graefe knife for sclerotomy since that has to be turned 90° while in the wound, is likely to stir up the vitreous excessively, and may fail to make an angular wound that will remain open. The description of the knife is accompanied with an illustration of it.

Lowell's foreign body *spud illuminator* consists of a fountain pen light with spring contact switch, to which is attached a smaller parallel barrel, equal in length, with a sliding member in this superimposed barrel. When the whole attachment is rotated on the fountain pen barrel, a tempered spring slides over the contact switch spring, thus giving a constant steady light. The spud is fastened in this sliding member. When pushed forward with the light on, the spud point and cornea are well illuminated. The spud is protected when not in use by sliding it back into the barrel.

East describes his electrically illuminated loupe. This instrument combines the corneal loupe, the condensing lens and the source of light in one small piece of apparatus which can be placed in the pocket, the chief advantage of such an arrangement being the free use of one of the surgeon's hands for separating the lids if necessary. The battery supplying the light is carried in the handle and can be renewed at the cost of a shilling.

Henry demonstrated a *speculum* which he had devised for the purpose of preventing a patient pressing his eyelids together, after an opening had been made surgically.

Francis presented a *needle holder* designed for the purpose of carrying a one-half curved needle. The holder is lightly, tho strongly built, has no lock, and possesses the advantage of easy manipulation for conjunctival or thin sutures. **Lang** has devised a needle holder, to which is attached a corneal loupe focused on the point of the instrument that may be placed in the holder.

Von Blaskovics devised and describes a safety speculum. At its 4 ends supporting screws hold it off from the eye. One pair of screws rest on the bones at the nasal side, the other on the temporal side. For complete fixation of the eye a suture is placed thru the superior rectus. The instrument proved very useful in a cataract operation on an imbecile patient and an old frightened woman. Blaskovics employs it in all cases in which prolapse of the vitreous may be expected.

A demonstration of surgical and ophthalmologic instruments was made by **Hessberg,** who took up questions of form and materials of which they should be made.

Some notes on the operative methods in use at the Royal Hungarian University Eye Clinic are reported by **von Grosz.** The second edition of **Terrien's** work on the surgery of the eye and its adnexae constitutes practically a new book on ophthalmic operations.

Operative Technic.—*Fixation.* For the ordinary cataract incision, fixation is best applied to the side by a firm grasp on the internal rectus tendon. **Gifford** uses a 10 per cent cocain solution four or five times within half an hour, or the injection of a drop or two of a 4 per cent cocain solution four minutes before the operation is begun, and thus avoids the necessity of providing against the possibility of the patient raising his eye in the majority of cases.

To fix for an incision with a spade knife, or for any of the filtration operations for glaucoma, it seems clear that the superior rectus offers the most favorable point. With the tendon firmly grasped by forceps, with three projecting teeth and a slide catch, the weight of the forceps holds the globe down, so that the operator can have both hands free for other work.

For trephinings and iridectomies under a general anesthetic, this method is most useful. For senile cataract extraction under a general anesthetic the best plan is to fix by the superior and internal rectus tendons, a double fixation.

Fixation by a strong thread can be used in a number of eye operations, in enucleations, for removing small malignant tumors; a thread thru one border of the tumor offers advantages over an attempt to fix with forceps. When a tumor is encountered in the orbit, fix with a strong thread before puncturing, so that its nature may be determined. If a cyst is punctured before being fixed it may collapse,
that it cannot be relocated without
ing unnecessary damage.

Perlmann fixes the eyeball perp
dicular to the section by a double fi
tion forceps. He describes it a
fork-forceps, which is just as sin
as the method with the one arm
ceps. By fixing the eye vertical to
section, he removed all the drawb
of the old methods without adding
new ones. He employs double
forceps provided with suitable m
ings which, by a bend in the ha
permit the knife to pass beneat
The slightly opened instrumen
placed vertically in the vertical
dian upon the eye and close to
limbus. Then there is above a spa
3 mm. for the formation of a con
tival flap. The description is ac
panied with an illustration
shows its application.

Brailey's modification of Angel
fixation consists of a silk lig
passed thru the superior rectus
don, and the two ends separate
brought to the forehead where
sistant fixes them with his finger
lid is thus held firmly out of th
while the eye is rotated downwa

Coppez recommends double fi
in cataract operations. The spe
is omitted and fixation forceps
plied to the insertion of the su
rectus muscle thruout the
operation. An assistant steadi
eyeball by fixation forceps app
the tendon of the internal
muscle, during the making of th
ture and counterpuncture and t
part of the corneal incision. A
fixation of the superior rectus
the operator to force out the
masses remaining in the upper
the lens capsule.

Cramer emphasizes the v
"stent" in *plastic work* involv
conjunctiva, and reports an ill
case.

Simpson's paper, on *safety*
thalmic operations is a summar
sons learned in technic of op
surgery by observing the worl
eral British ophthalmic surgeo
paper is divided into two parts;

part covers the preliminary examination, culture and treatment, and the second part the operation. Emphasis is laid on the importance of routine examination of adjacent skin, margin of lids, the conjunctiva and the lacrimal sac, accompanied with cultural methods for the recognition of any infecting microorganism and the appropriate treatment of the same. The conjunctiva is washed three times daily with a lotion of hydrarg. perchlorid, 1-10000, and daily painting with two per cent. silver nitrat solution. In mild infections zinc sulphat, gr. 1 to ounce, is instilled three times a day, and protargol 10% dropped into the conjunctival sac once daily. Obstinate infections will often clear up quickly with the use of copper sulphat drops, gr. 3/4 to ounce.

The expression of the meibomian glands by a blunt glass rod is in some cases a useful procedure. The presence of a mucocele is an absolute bar to an operation. The sac should be excised and the puncta sealed by touching with the cautery. This applies to the other side, which is not to be the subject of operation. The author enumerates a number of practical points in operative technic, beginning with the use of long sleeved sterile gown for the surgeon and all assistants, and caps and masks, the preparation of the hands, and sterilization of instruments and the irrigation of the eye, etc.

Holland gives notes on *statistics* of 2,412 eye operations performed in 29 days. The type of case and operation and number of such cases are classified. There are 1,203 cataract extractions with 0.75 per cent. of sepsis; 95 per cent. are operated by the intracapsular method. He sees glaucoma cases that had been operated on five or six years previously, those who were trephined showed better results than where iridectomy was employed. In early pannus, trachoma, early corneal opacities and phlyctenular ulcers, he employs subconjunctival injections of salt solution, using 10 to 15 m. The results are good.

In operations where there is danger of *loss of vitreous*, **Van der Hoeve** proceeds thus: He puts 4 threads with fine needle thru the sclera without perforating it, near the cornea at 90 degrees distance from each other. At the place where the bulbar incision is going to be made, he puts a corneoscleral thread. Two assistants take each two threads. The bulb is opened in the limbus between the two parts of the corneoscleral threads; the incision if necessary is enlarged with scissors. In a threatened loss of vitreous the assistants pull with equal force the threads outward and forward, which brings the bulbar wall outward and the pressure becomes negative. After finishing the operation, the corneoscleral suture is tied and the four threads removed. The corneoscleral suture is removed in 24 hours. Van der Hoeve thinks this procedure is helpful for removal of a luxated lens from anterior chamber or vitreous, of subluxated lens from pupil, cutting away of secondary cataract, removal of lens in its capsule, cataract removal in eyes in which we know or can surmise with confidence that the vitreous is fluid; operations on eyes without a lens, also for freeing anterior synechiae from the cornea.

In the discussion Tresling corroborated the good results. By putting the threads towards the ocular muscles, he could make a bag-mouth suture, in a case of lens luxation, and would not need the corneal suture. Weve feared greater danger from infection thru aspiration and the assistants. Zeeman believes much in the upper and lower threads, because after incision these scleral points will be in need of greater assistance than the temporal and nasal ends of the horizontal meridian.

For synechiotomy without the corneal suture, the procedure has given him good results. Wibaut mentioned that Bader has shown with tonometric measurements that the chances for vitreous loss in young people are greater than in old ones, and recommends the method for young cataract patients. Van der Hoeve finds that the corneoscleral suture does not make the incision more difficult. He fears that if the threads are put farther back there will result deformity of the bulb. The danger from aspiration can be prevented by careful removal of the fluid. The upper and lower threads were of most value and helped to fix the bulb.

Pichler recommends women's hair for facial surgery and cosmetics on account of its great flexibility and lack of causing irritation. It allows the placing of the sutures very close and thus aids very good adaptation of even very irregular wounds. Before boiling the hair was placed in alcohol for 24 hours.

Alexander describes a *position of the head* favorable to the operation for cataracts. The head is thrown back about 40° by lowering the end of the table or by moving the pillow from under the head to under the shoulders, and rotating it about the same degree to the side opposite the eye to be operated upon, and then directing the patient to look straight up to the ceiling.

COMPLICATIONS.—**Miller** believes that *tubercular infection* is a cause of delayed healing in operations on the eye. Two cases are reported which seem to him to establish his belief. A man, 30 years of age, received an injury to his left eye. A piece of glass from a broken lens made a cut about 8 mm. long, extending from a point 6 mm. on the cornea inside the limbus, at 3 o'clock, thru the cornea, ciliary body and sclera straight back over the site of the external rectus muscle. The iris protruded and farther back a bead of vitreous presented. The necessary operation to care for the injury was performed and the patient put to bed. On the 3rd day two abrasions on the cornea were noticed, which appeared to be infected, one about 2 mm. in diameter, at 7 o'clock, just inside the limbus, and another about 3 mm. in diameter, at 6 o'clock, 3 mm. in the limbus. These abrasions not only resisted the treatment employed but became more extensive, and between them and from the limbus below vascularization appeared. After a period of two months, an examination with a loupe showed these areas to have an appearance similar to those seen in tubercular ulcers of the cornea. Koch's old tuberculin, beginning with 1/1000 mg., was administered and gradually increased every fourth day until 16 doses were given, the las dose being 1/8 mg. Almost immediatel the ulcerated areas began to clear an the eye was nearly quiet at the end c 2 months. Miller reports another cas with a similar corneal involvemer which cleared up under tuberculin.

Kubik describes a case in which en cleation was performed in a glaucom tous eye with secondary hydrophtha mus under local anesthesia of the c iary ganglion. *Novocain-adrenin* 1% w used, and not more than 2 c.c. were i jected. Ten minutes later, vomiting s in, followed 12 hours later by motor i volvement, backward bending of t head, stiff neck and other phenomei The diagnosis of pseudomeningitis w made. Lumbar puncture showed gr pressure of the cerebrospinal fluid, w a bloody tinge and greenish discolo tion. Bacteriologic examination of fluid was negative. The temperat was 38.2 degrees C., reduced on third day to normal. Discharge fı the hospital on the eighth day.

Etiologically, two causes may considered: 1. Hemorrhage develo in the subdural space caused prob by pushing the needle too far forw 2. Intoxication by the injection of vocain into the skull.

Butler states that *mental derange* has been observed after his op tions with comparative frequenc is a factor which must be consid in deciding whether an oper should be performed. In the aged factor is more urgent than in young. The disturbance may be or severe, transient or permanent. patients who became permanentl sane have generally shown symp of insanity before operation, a strong hereditary taint can frequ be discovered. He has been abl few instances to diagnose the dis before operation, and has refus proceed with the treatment. He c two case records to illustrate point. His conclusion after revi a series of cases are summed up following points: There is usu family history of insanity. Nea his examples were operated or hospital and were placed in wards. The radical change in their surrounding was a factor. Special eye wards are necessary for the best results. The wearing of a double bandage is not a cause.

Ripley, in discussion, was inclined to the view that atropin might be a cause of some of the minor cases, and preferred to employ scopolamin. Butler replied that atropin was not used until the end of 48 hours, and few of his examples were under atropin. His experience was that scopolamin was a more toxic drug than atropin and more liable to cause delirium.

Guiral y Viondi writes on the surgery of the eyeball and its technic. The scope of the work is strictly limited to operations on the globe itself. A single operation of each kind is described minutely and clearly.

Maynard's Manual of Ophthalmic Operations is not an exhaustive work on eye operations, but a clear concise account of those procedures that have been found most valuable in practice.

Zur Nedden reports further good results from his method of withdrawing with a Pravaz syringe 0.5 to 1 c.c. of the *liquefied vitreous.* So far he has performed paracentesis 65 times on 21 eyes, mostly ambulant cases. Adherent opacities cannot be removed by the syringe. They as well as compact stripes after hemorrhages and retinitis proliferans gradually disappear after repeated paracenteses, which improve absorption by renewal of the vitreous. Cyclitic membranes are very refractory to this treatment. The author examined the aqueous and vitreous repeatedly drawn before enucleation from an eyeball affected with traumatic glaucoma and one after a perforating injury. He found that the aqueous and vitreous of uninflamed eyes contained no fibrin in contrast to the eyes of rabbits. His observations proved that by paracentesis of the vitreous, some eyes threatened in their existence can be saved, and that some, which in consequence of dense opacities of the vitreous were, according to our present views, considered as blind, regained good vision.

General Considerations. — **Rush** suggests the following four *exercises* to overcome stiffness in the thumb and fingers and to give more perfect control of them. 1. With force press the thumb toward the little finger, i.e., press the thenar against the hypothenar eminence. 2. Forcibly flex each finger and at the same time press the finger backward. 3. Extend all the fingers to the limit by pressing the corresponding fingers of each hand together. 4. Practice the child's game of crossing the second finger over the first and vice versa.

A good practice as suggested by Dr. Howard, is that of doing the common or usual things in an unusual way, e.g., one may reverse the use of his hands in eating, in brushing the teeth, in combing the hair. **O'Connor** suggests tennis and target shooting to cultivate mental and physical steadiness.

Van Lint at the time of operation had employed injections of sterilized milk to prevent complications due to infection. Five c.c. were given preceding operation and the results were gratifying.

Elliot's book on "Care of Eyes" is a manual for nurses, students and practitioner. Part I takes up nursing of ophthalmic cases, anatomy, diagnosis, and instruments. Part II treats chiefly of diseases.

In 153 iridotomies, reported by **Bartók,** of which 133 were following cataract operations, the result were improvement or cure in 124, no change in 20, and made worse in 9. In 9 cases there was prolapse of the vitreous. In 5 cases of secondary glaucoma, the result was improvement. The author says that the operation must be deferred until all inflammation has subsided, except in the case of chronic inflammations, especially those associated with glaucoma, which will be relieved only after the normal circulatory conditions are reestablished. This is also true of cases of iris incarceration. If the first iridotomy fails, a second may succeed, by waiting until all inflammation has subsided.

Anomalies of Refraction and Accommodation

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This section reviews the literature of 1921 referring to optics, refraction and accor modation of the eye, and the general subject of lenses and their practical use. For pr vious literature see Volume 17, 1921, p. 25.

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DIGEST OF THE LITERATURE.

OPTICS.—The theoretic and practical development of the optical aids to vision in spectacles and eyeglasses has been greatly furthered during the last five years. Such progress has been effected by the combined efforts of scientists and practical opticians. **Henker** has brought together these results in an octavo volume of 325 pages with 339 diagrams. This work is easy to read and requires no preliminary knowledge. The necessary fundamentals of geometric optics form the opening chapters. The optical properties of spectacles are alone considered; frames and mountings are not touched upon. The effects and faults of the spectacle as applied to the eye at rest and in movement, as well as the remedies for these faults, are treated exhaustively. Mathamatic formulae are few. Altho the book is primarily intended for opticians, it will be found of interest and value to oculists also.

Booth's book upon "Radiant Energy and the Ophthalmic Lens" is a study of the principles of optics of the eye and its functions. It contains many definitions and explanations not usually found in works intended for the ophthalmologist. The larger number of these are in the chapter upon Radiant Energy, in which a good account is given of *diffraction, polarization, cathode rays* and Einstein's *gravitational theory* of light. The diagrams are clear, simple, and always explanatory. The book is well worth having if only for the unusual data and discussion it contains.

Sheard's brochure upon Transmission of *Radiant Energy* by Ophthalmic Glasses is a reprint from the American Encyclopedia of Ophthalmology. It is divided into 4 chapters: The 1st gives a very interesting account of radiant energy, the 2nd treats of common methods of producing and investigating the different radiations, ultraviolet, visible and infrared; the 3rd, of the transmission and absorption of these radiations, and the last chapter deals with the transmission of the ocular media. Spectra are reproduced in illustrations, or graphs, indicating the relative absorption and transmission of light and radiation most nearly similar to it.

Wiener discusses the relation of recent observations, such as polarization, interference, refraction, etc., to the emission theory of Newton and the wave theory of Huygens. Altho the latter has been accepted for a century, under the influence of Planck and Einstein there is a turning towards Newton, in as much as it is believed that "light corpuscles" are given off by illuminating bodies. The author believes it is possible to combine the corpuscular theory with the wave theory, and refers to Ritz, Michelson and Lorentz as to difficulties in accepting the wave theory today.

Utterbach has experimented upon the *transmission of light* of different wave lengths thru fog—thick, medium and slight. The experimental results show that the transmission is at its maximum for wave lengths from about

5300 t.m. to about 5900 t.m., and that it falls off very rapidly toward the red but not so rapidly toward the blue. **Tscherning** has written on Fechner's law.

Montgomery defines optical glasses with reference to their behavior to transmitted light. This behavior depends upon the composition of the glass; each constituent has an effect on the index of refraction and the dispersion, and these two properties identify the type of the glass. A study of nearly 90 kinds of glass brings out that there are 23 ordinary types of quite similar optical properties, composition and method of manufacture. The study shows that very large changes are necessary to change the optical properties to any extent; and also that if the index of refraction and dispersion are to be kept constant for any one glass, any small variation in composition will be disastrous; a variation of 0.1 in the important oxides will affect the index from 0.5 to 1.0 in the third decimal place and the dispersion from 1 to 5 in the first decimal place. The relation between refractive index and dispersion is graphically shown on coordinate paper.

Weiss thinks the psychologic and physiologic color doctrines cannot describe the signs which are important for absorbing eyeglasses, and one will have to resort to exact spectral-photometric characterization for their determination. For practical purposes considerable simplification is possible by determining the absorption by the most marked maxima and minima of permeability, its limit in ultraviolet and its absolute value in the maximum.

Glancy writes upon the power of *spectacle lenses.* He explains the four current expressions for power: Approximate power (D_1+D_2), where D_1 is the power of the front surface and D_2 the power of the rear surface; then D_1+D_2 is a good approximation to the power of a thin lens, but not good enough for accurate work and thick lenses. Equivalent power means the reciprocal of the equivalent focal length; its formula is $D_1+D_2-sD_1D_2$. Effective power means the reciproc of the "back focus," sometimes call "vertex refraction," being measur from the rear surface as the point reference; its formula is D_1+D_2+s +, where s equals center thickness vided by index of refraction.

Neutralizing power; which equ the lens required to neutralize a giv lens. Its formula is $D_1+D_2+sD^2_2$ The first formula is rigid, the otl two are not. A table shows the ference between the three powe these powers are discussed in detail is also the effect upon the eye of position of the lens. **Raeder** exami with the astigmometer of Tschern the optical qualities of different ty of spectacle lenses, and discusses th in detail. Equiconvex and equic cave lenses ought never to be scribed, and if economy comes question, planoconvex and con lenses should be used instead; ot wise the punktal acting lenses, stigmatic lenses of Ostwald Tscherning and katral lenses of G strand give almost ideal results. cave periscopic lenses and co menisci also give great satisfactio

Percival gives the formulae prismatic decentration of lenses, the sphero-cylindrical equivalen oblique cylinders. From the st point of phenomena observed in tical experience, **Banfield** discusse anatomic relations of the eye to of light, as conceived by de Scl nitz. **Springer** has written on for optical purposes and how made.

Schoute observes that Gauss's ula for the second focal point ma to the erroneous opinion that th fractive power of a spectacle le minishes as the distance betwee eye and the glass increases shortening of the second foca tance, however, is more than co sated by a displacement of the principal point, having for resul the increase of the distance be the lens and the eye leads to aug tion of the refractive force of the **Roelofs** adds that advancing th tacle may replace the accommo not only in the hypermetropic but also in the myopic. The formula between the relation of the object and image, in terms of the focal distance ($l_1 x l_2 = F^2$) shows this very clearly.

After referring to the work of Gullstrand and others, **Chacon** observes that the best way to avoid the astigmatism of incidence in correcting glasses is to place them so that the line of vision shall always be perpendicular to the lenses, this line to coincide, therefore, with the principal axis of the lens. Where correcting glasses are intended for distance, they should be placed vertically; for near use, they should be somewhat inclined, the upper edge being slightly tilted forward. Radial astigmatism is less marked in periscopic lenses, still less in torics and can be fully corrected by Gullstrand's form; he has therefore named the latter "aspheric."

In discussing the genesis of accommodative micropsia and macropsia, **Lohman** concludes that physical factors, which produce a change in the size of retinal images, do not play a decisive role in the etiology of accommodative micropsia. **Esser** also takes up the study of microscopy and macroscopy and accommodation. **Hegner** writes on spectacles, and **Bates** gives his views on physiologic optics. **Moulton** discusses human eyes and optical instruments.

NORMAL OCULAR REFRACTION. **Southall** writes upon the refraction and visual acuity of the human eye. He discusses the position of the cardinal points, refractive power, image equations, resolving power and visual acuity, focus, depth, and accommodation, etc. A number of diagrams illustrate the subject; the equations are derived by comparatively simple mathematic methods.

Helmholtz explains the luminous radial streamers, which are seen when a very small and intensely luminous light is viewed against a dark background, as resulting from the *diffraction of light* at the irregular margin of the pupil of the eye. **Raman**, from a series of experiments with white and monochromatic light, finds that the effects present a striking resemblance to the phenomena observed when light is diffracted by a large number of irregularly placed apertures or particles of uniform size, e.g. lycopodium dust strewn on a glass plate. He concludes that the phenomena of radiation above mentioned are due to diffraction by particles included in the refractive media of the eye. These particles are presumably in the cornea and vitreous humor, as histologic evidence of cellular structures in these bodies is available. Upon this question, however, the author expresses no opinion.

Sheard remarks that the *axial length of the eye* of a new born child is but 17 mm., instead of 24 mm. of the normal adult eye, and as the refraction of the child's eye is but slightly hypermetropic, the shorter axis must be compensated in some way. Such compensation has been found in the increased curvature of the crystalline lens. As the child's eyes grow, therefore, two opposing conditions are at work; the curvature of the lens diminishes while the eyeball elongates; hence the eye tends to emmetropization constantly as it grows.

Hartridge summarizes the evidence on which the *inversion of the retinal image* is based, against a recent statement of Senet that such image is not inverted. (1) Upon examination of the eyeball of an albino animal from the posterior surface, the retinal image is seen to be inverted, top being at the bottom, and right being at left; (2) if the choroid and sclera be carefully removed from the eyeball of an ordinary animal, the retinal image can be seen to be inverted and transposed; (3) the blind spot lies to the temporal side of the point of fixation; if the angle subtended by the eye and the blind spot of fixation be measured, it is found to be equal to that of the fovea and center of papilla as measured from the posterior nodal point; (4) opacities in the media cast shadows which cause areas of blindness occupying the opposite segment of the visual field; (5) by applying a powerful light or sharply localized pressure to the exterior of the eyeball, a glow is seen to occupy the opposite segment of the visual field to that in which the stimulus has been applied. The above evidence for the inversion of the retinal image is conclusive.

Sheard shows how the *lack of achromatism* of the eye can be demonstrated. If a spectrum be regarded in a spectroscope, it is impossible to have the red and violet in focus at the same time; if certain test types are easily read at 20 feet but no further, it will be impossible to read them when illuminated with blue-violet light. If a series of concentric black circles are slowly approached toward the eye, a point will be reached when these circles appear colored. The above and other similar experiments clearly show the lack of achromatism of the human eye. (Such defects as these were what Helmholtz meant when he declared that if an optician sent him as imperfect an optical instrument as the human eye, he would return it to him. Such defects, however, do not interfere ordinarily with the function of vision; the eye is optically as perfect as it need be. Rev.).

Alexander contends that the prevailing teaching that in the *crystalline lens* there are surfaces acting as concave surfaces, and that the increase in the index of refraction of the cortex, by increasing the refractive power of these surfaces, is the cause of the diminution of the power of the lens as age advanced, is a mistake; there are no such concave surfaces in the lens, but the lens acts simply as any other convex lens placed in a medium of lesser index of refraction than its own. He contends that the cause of the diminished power of the lens as age advances is the increase in the radii of its surfaces and those of the nuclei, resulting in diminution of their convexity.

De Haan examined with four different objects the vision, the perception circle, the perception extent, the optical extension sense and point of vision, with different illumination and different contrasts. He examined normal persons and 60 myopes. He proved that the vision is rather regularly disturbed in *myopia,* and that wi
diminishing illumination and contra
vision diminished to a greater extent th
in emmetropes. But for the optical exte
sion sense, the influence of illumin
tion and contrast appeared less d
tinct. Conclusions are drawn regai
ing the position of the cones and t
eventual distension of the retina.

Wibaut refers to the communicatic
of Barneck and Verrey (1893) a
Charpentier (1902), that in the *dark*
fraction becomes stronger. These
vestigators concluded that light p
duces a stronger filling of the choroi
vessels, the disappearance of which
darkness causes recedence of the
tina with consecutive myopia. Schc
in 1903 and also Zeemann were un
to demonstrate this, while Wib
could prove it clearly for himself. '
explanation is partly found in
phenomenon of Purkinje, which ex
also for the fovea (Hering); in
planation of this he refers to the
vestigations of Ogata and Weym
(A. J. O., Sept. 1918); the deeper si
tion of the parafovea in some eyes.

The Ophthalmometer. In a p
upon ophthalmometry, **Sheard** giv
description with illustrations of the
ferent parts of the ophthalmomete
notes certain practical points to b
served in using the instrument.
lowing some theoretic consi
tions, he gives results obtaine
measuring the radii of curvature c
anterior surface of the cornea, th
erage being about 7.5 to 7.65 mm.
possible value of ophthalmor
curvature in hypermetropia and
opia is considered, leading to the
ment that such measurements of c
ture probably give informatio
value in many cases. In irregul
tigmatism also, the images o
mires are of value in detecting
condition, for they show distorti
the corneal image when corneal i
larities exist. The most valuab
jective test in keratoconus is fur
by the ophthalmometer. Whil
instrument is not generally capa
locating the axes with exactness,
measuring their powers, it does
a close approximation. The

tages of ophthalmometric measurements are considered, as are also the relations between the corneal and total astigmatism. This paper is an exhaustive account of the construction and use of the ophthalmometer.

SKIASCOPY. **Dufour** gives a simplified demonstration of skiascopy. He has constructed a model showing the course of the rays and the form of the pencils in the astigmatic eye, the source of light being punctiform as in Jackson's method. **Marquez** again discusses the subject of skiascopy. **Bennett's** instrument combining a plane with a concave mirror, and a convex lens for presbyopic abservers has been described under diagnosis. **Kraemer** has rehearsed the theory of skiascopy.

According to **Lindner** there is only one way of measuring objectively the astigmatism, and this is the skiascopy with cylinders. He gives the description and explanation of the particulars of his method, which cannot very well be given in abstract.

DARK ROOM. **Olsho** figures a dark room to be arranged in one corner of the consulting room, the dimensions of which should be at least 5x6 ft. The roof is compo or Bristol board painted dead black; the sides are heavy opaque shades of black cambric on steel rollers.

SUBJECTIVE TESTS. **Ferree** and **Rand** suggest a method for the detection of small errors of refraction, particularly astigmatism, based upon the principle that an eye which suffers from an insufficient resolving power shows, among other defects: That an increase in the amount of light is required to discriminate details in the standard acuity object. If the eye has equal resolving power in all meridians, the amount of light required just to discriminate the test object in all meridians will be the same. If the resolving power is not equal, the amount of light required will be different in the different meridians by an amount proportional to the amplification represented by the illumination scale.

Used in this way the *illumination scale* becomes in effect an amplifying scale—somewhat analogous to the tangent scale in detecting small defractions in the magnet system of a galvanometer, and has an advantage in sensitivity in proportion to the amplification. In clinic practice it has been shown to be of particular value in determining the exact amount and placement of the correction of astigmatism. The relation of intensity of illumination to acuity is illustrated by a curve upon coordinate paper.

A convenient apparatus for using the illumination scale is described in the same Journal. In this apparatus, uniformity of illumination of the test surface was secured by projecting upon it the image of an evenly illuminated aperture at the inner end of the projection tube of a lantern. The source of light was a 100 watt type-C Mazda; the test object was a broken circle, fastened at the center of a graduated dial, the opening of which (visual angle, 1 minute at 6 meters) could be turned into any desired meridian; the angle of turning could be read in terms of the divisions on the dial, which was graduated to correspond to the readings on the ordinary trial frames.

In the testing and demonstration of the sensitivity and serviceability of the illumination method for determining the exact amount and placement of the correction of an astigmatism, the following types of materials were selected: (1) artificial astigmatism made with weak cylinders, (2) natural astigmatism without a cycloplegic, (3) clinic cases with a cycloplegic; (4) clinic cases previously refracted by objective and subjective clinical methods; (5) irregular astigmatism. Several cases of each class are reported in detail. The paper concludes with a discussion of various points of the method with suggestions for its application in practice.

Maddox suggests three new *subjective tests for astigmatism*: The V test—A V is made to move around the periphery of Snellen's small fan of lines by means of a string. It serves to show which ray of the fan is best seen, and, secondly, as a confirmer to test the correctness of the patient's choice, for if the correct ray has been chosen, the two arms of the V will appear equally distinct. The V should always be moved in the direction of its blackest arm until the two are equally black. It will now be found to stand opposite the correct spoke of the fan. As in all tests of this kind, the patient's head should be kept perfectly upright, and he should be made myopic for one of the principal meridians and emmetropic or only slightly myopic for the other. The Arrow Test: This consists of a broad feathered arrow, rotatable about its center, and with a fixed graduated semicircle below; on turning the arrow in the direction of the most distinct feather till the two feathers appear equally clean, the arrow head points to the required axis. For very young children to whom the idea of an arrow is not familiar, and who confuse right and left, the reporter uses two squares called "pocket handkerchiefs," one above the other, and two striped circles called "balls," also one above the other. The child is quick to see which is the cleaner handkerchief and the pettier ball, and thinks it rather a nice game.

Sheard points out the great difficulty of accurately determining the amount and principal meridians of very low degrees of astigmatism. Neither the subjective method nor the shadow test are sufficiently delicate. He accordingly approves of Ferree and Rand's demonstration that *illumination* can be used as the determining agent. Their device is essentially a projection lantern with a Mazda lamp illuminating an aperture screened with ground glass provided with an iris diaphragm to vary the illumination contained within the light image thrown upon the letters upon the chart; the scale attached to the diaphragm gives the illumination in meter-candles.

The instrument also possesses other uses. Among these may be mentioned: (1) A means of illuminating the type with a constant and known intensity of light. (2) Testing of scotopic or twilight vision, and the rate of scotopic adaptation. (3) Testing the light sense directly, in terms of the amount of light required to arouse just noticeable sensation. (4) Testing small errors of refraction by determining the minimum of illumination with great exactness. The tests for small amounts ol astigmatism and the effects of shiftin the axis of a correcting cylinder i based upon the principle that if the resolving power of the eye is not th same in all meridians, the amount c light required to just discriminate th test object will be different in differer meridians.

Ferree and **Rand** have found that i the astigmatism produced by 0.25 cyl. about 100% more light was r quired for the discrimination of the te object in the worse as compared wi the better meridian. Experiments wi such artificial astigmatism may r hold exactly with natural astigmatis the naturally astigmatic eye doubtl learns to compensate in part for its fects. But in essentials such tests these may be usefully applied in cl ical procedure. In an article u "Letters for subjective testing of fraction," **Jackson** observes that letters are used for two entirely dif ent purposes: one to test the acuter of vision at the point of fixation, other to test the effect of lenses on clearness of perception of such lett For the first purpose, the variation the visibility of the different letters defect, but for the subjective testin refraction these differences of visib add greatly to the usefulness of test letters.

For the subjective measuremer errors of refraction, it is desirable as many letters as possible shoul employed, provided they can be tinctly formed within the same e of space. Thus between L most seen, and B that needs to be n twice as large to be recognized, w introduce several letters of int diate visibility and thus test four improvements of distinctness o ception, on a single line of as mar ters. It is such fine graduations make the subjective test the fir biter.

To use the test letters to be vantage, two distinct methods be employed; one is to ask the whether a certain change in the glass makes the sight better or worse—a truly subjective test. The second method is to require the patient to prove that he sees better, by recognizing letters that he has not previously recognized,—thus adding an objective test. To carry this out it is necessary to substitute cards with which the patient has not become familiar. Finally no set of test letters is complete unless it includes one or more lines that require better than the standard vision for their recognition; for the better the vision of which the eye is capable the more likely it is to be annoyed or strained by an inaccurate correction.

Gros admits that exact skiascopy under prolonged atropinization and ophthalmometric examination gives a solid basis for prescribing correcting lenses: As, however, for diverse reasons, atropin is not always practicable, it is highly desirable to discover by clinical methods any latent hypermetropia which may be present, or myopia of spasm. Sulzer has called attention in the French Encyclopedia of Ophthalmology to the asthenopia without astigmia, or manifest hypermetropia upon subjective and ophthalmoscopic examination; in which, however, correction of latent astigmia induces relaxation of the accommodation and brings out latent hypermetropia. There is no fixed relation between the ametropia and the age.

The following case is cited: female, aged 31, inverse corneal astigmatism 1.50 D. By skiascopy the vertical meridian gave—5.D., direct astig.—2.D. After three days of atropin the vertical meridian showed +5.D., with inverse astigmatism +2D. A considerable degree of manifest anisometropia may also vanish after cycloplegia. In such cases, a cycloplegic is alone absolutely reliable, but certain very simple methods will reveal part of the error at least, and may spare the patient the annoyance of having the accommodation paralyzed. Landolt's method, in suspected latent hypermetropia, of placing convex lenses before the eye of increasing strength, and letting them remain in that position a short time to encourage relaxation of the ciliary muscle, is uncertain.

It is much better to supplement this method by increasing the strength of the lenses until the vision is lowered somewhat; and then covering the eye for twenty or thirty seconds, at the end of which time it is to be rapidly uncovered and the patient asked to read immediately the smallest letters he can distinguish. In this way small letters are read at first, which quickly become blurred as the attempt is persisted in, thus proving the presence of a latent area. The same method may be followed in myopia by the use of a weaker concave lens than one previously chosen. It is frequently stated that the accommodation relaxes during ophthalmoscopic examination in a darkened chamber; but such relaxation often fails to occur. The writer has found that a strong convex lens placed before the eye not under examination may serve to bring out latent hypermetropia, by skiascopy of the other eye in many cases. Spasm of the accommodation may also be unmasked in many cases by a strong convex lens in hypermetropia, or a weak one in myopia by combination with a 4 to 6 degree prism base in.

None of these procedures for uncovering accommodative spasm is infallible, but if the precaution be taken during skiascopy, of placing before the eye not under examination, a strong convex lens or converging prism, there is a good chance of recognizing conditions at least and paving the way for a cycloplegic if such be thought necessary.

Trantas has devised a special method of measuring the refraction, which he terms "Velonoscopy," "*Velonoskiascopy*" or "auto-skiascopy," a subjective method for determining the refraction. Moving a pointer before the pupil, while this eye looks at a distant luminous point, the hypermetrope will see a shadow which moves in the opposite direction to the pointer, while to the myope it moves in the same direction. Astigmatism is revealed by the difference of the shadow in the principal meridians and by the lack of parallelism between the pointer and its shadow in the intermediate meridians. The method gives more accurate results than skiascopy as regards the amount of the ametropia; it is particularly valuable for the determination of the axis of the correcting cylinder. **Polack** observes that Trantas' method (Velonoskiascopy) gives a precision of one-eighth diopter and reveals unsuspected astigmatism in numerous instances; it is an excellent control method for verification of the axes of astigmatism.

Critchley, writing on refraction work in children, says that any education committee which expects the medical officer to complete six cases in an hour expects poor work and unsatisfactory results. But he thinks three an hour might be required. The subjective test must have the last word. In clinics where objective tests are relied on exclusively, a large number of children express discomfort and return again and again for repeated examinations.

Bahn thinks the purpose of subjective testing for glasses is the determination by the best, easiest and quickest manner of the one lens combination which positively affords the greatest vision. There can be but one such lens. A retinoscopic approximation reduces the innumerable lens possibilities to comparatively few. The first approximate test is the retinoscopic finding, and each successive test is an approach to the one best lens affording better vision than the preceding test. Not over ten comparative tests should be required of an eye in immediate succession; and comparisons should be required both on presentation and withdrawal of test units. The test of glasses prescribed is the duration of their comfortable use. He considers atropin tests more successful than homatropin, but a retinoscopy and two identical successive homatropin tests allow glasses to be prescribed. When the results of the two tests are not similar atropin is recommended. Homatropin has the advantage of less prolonged cycloplegia. **Sutherland** and **Hopton** have written on refraction work on children.

CYCLOPLEGIA.—Altho homatropin
usually harmless, **Hochgurtel** repo
3 cases of general toxic sympto
One was that of a patient aged 74,
whom it was used for a better exami
tion of a partial cataract. He suffe
cramps in the arms and legs, that
gan after about 30 minutes and las
until two hours after the instillation
repetition of the instillation broug
recurrence of the symptoms. The ot
patient, a 12 year old girl, had insti
tions of a 1 percent solution, ten
utes apart, when alarming sympt
were manifested. There were vi
hallucinations and cramps in the a
and legs. The symptoms passed
in about 9 hours. In a girl of 10,
drops of the 1% solution ten mi
apart were followed in twenty mi
by weakness of the legs, which pa
off in about an hour.

Ganguly reports the case of a he
boy of 14 who was ordered 1% at
sulphat three times a day for
days. Three months later he ret
with the pupils two-thirds dilate
inability to accommodate so th
could see to eat or read. A month
he was better but not normal. **G**
has written on atropin in refra
and **McCabe** on cycloplegia in
tion.

TRANSIENT CHANGES OF REFRA
—**Magitot** reports four cases of *t*
tic myopia. In 3 of these, foreign
had entered the orbit but
ascertainable wound of the glob
tho the optic nerve may
garded as having escaped injur
may not have been true of the
fibers, either at their extrabu
subscleral paths. This was in
by the corneal anesthesia pre
two of the cases. The observati
show that atropin has at tim
slight effect upon spasm; whic
unaffected either by general an
or puncture of the anterior char
the first case, there was a forei
in the orbit; traumatic myopia
potension yielding spontaneou
without treatment. The pupil
normally but presented a sligh
without deformity.

Case 2 was one of contusion and traumatic myopia: the latter disappeared spontaneously. The contusion was accompanied by slight hyphema with a corneal erosion; there was a slight deformity of the pupil at a point corresponding to the corneal lesion, in which region, also, the motility of the iris was decidedly diminished. Tension was lower than in the opposite eye; the myopia persisted 20 days.

Case 3, foreign body in orbit; traumatic myopia with tendency to spontaneous remission and relapse. The ciliary spasm yielded to instillations of atropin; on suspending the mydriatic, there was recurrence of the spasm with spontaneous remissions. Puncture of the anterior chamber was without influence, either in relieving the spasmodic condition or in provoking a recurrence.

Case 4, penetrating wound of the upper lid, ophthalmomalacia. Persistent spasm of accommodation, no tendency to spontaneous remission and remarkably resistant to atropin, uninfluenced both by general anesthesia and puncture of the anterior chamber. Pupil contracted but not deformed; Light reflex sluggish, particularly at the supero-external sector, corresponding to a region of corneal anesthesia; tension greatly lowered.

Bailey's first case was a deep injury of the cornea with commotio retinae; the tension was slightly lowered. On the fourth day after the injury the eye was found to be myopic, 2.50 D. Two days later the refraction had become emmetropic. The question of the cause of such temporary myopia suggests various possibilities, such as increased corneal curvature, alteration in the composition of the aqueous humor, increased length of the axis from a weakened sclera, abnormal relaxation of the suspensory ligament of the lens, etc. It could not be attributed to irritation of the ciliary muscle, as the eye was fully atropinized. His second case was one of penetration of the cornea by a metallic foreign body extending slightly into the anterior chamber. Removal by the magnet; vision 20/20. The third day there was a rupture of the cornea with obliteration of the anterior chamber; vision 20/200; myopia of 8 D. (retinoscopy). The following day the chamber had become reestablished with emmetropia and normal vision The transient myopia in this case is explained by the advance of the lens with resulting forward shifting of the focal points.

Hagen reports transitory hypermetropia in diabetes and says that various disturbances of vision can occur, but disturbances caused by change of refraction are rarely seen. If they do occur they are of two kinds; transitory myopia and transitory hypermetropia. Of the latter, in 5 cases reported the condition seemed to occur 8 to 9 days after the patient had been on a diet. He thinks the condition is not a pure complication of diabetes, as is cataract or paralysis of accommodation. What changes occur in the eye during development of this transitory hypermetropia are not known, but they are probably to be found in the lens.

Roberts reports five personal cases and a number of others from literature, in which an *increase of hyperopia* occurred in *diabetes*. He holds that this increase of hypermetropia is not due to lens or vitreous changes alone, but to a combination of the two, caused by a lessening of the amount of sugar and salt in the blood and an alteration in the blood volume.

Amsler observed two cases of *burns of the conjunctiva* with slight involvement of the cornea at the limbus, followed by high astigmatism, 6.D. and 11.D. respectively. At the expiration of two months, the astigmatism had almost entirely disappeared.

Ormond reports three cases of temporary astigmatism in patients having *meibomian cysts,* in which the astigmatism disappeared or diminished upon incision of the cyst. The degree of astigmatism produced varied with the size of the tumor.

HIGH HYPEROPIA.—**Pfingst** observed hypermetropia of both eyes 17 D., with vision in one eye 20/100; in the other fingers at 8 feet. The writer comments upon certain features in the structure and function of such highly hypermetropic eyes. **Ellett** states that hyperopia of between 5 and 10 D. is not sufficiently rare to attract attention. He reports four cases in which the refraction ranged from 10 to 26 D. of hyperopia. He also reports a case of microphthalmos in which there was not more than 5 D.

Among the cases of high error of refraction which **Simon** found in military service were a few of high hyperopia which did not unfit its possessor for certain special duties.

APHAKIA.—**Lewis** reports two cases of aphakia with *apparent focal adjustment.* In the first case the patient could read J.1 at 7 inches with the distance correction with both eyes. With the left closed, he reads J.1 at 9 inches. With the right eye closed, the acuity gradually increases until he is able to read J.4 at 3 inches, becoming defintely clearer with conscious effort. The pupil does not change in size, the ophthalmometer shows a slight change in corneal curvature.

In the second case, without glasses, the operated eye is able to pick out words of J.6 at 5 inches; with his distance correction he is able to read J.1 easily between 9½ and 22 inches.

The explanations usually given, i.e., small pupil, larger size of retinal image, increased power of interpreting circles of diffusion and tilting of strong convex lenses, all seemed inadequate to explain the phenomena in these cases. He believes that they must be ascribed to the action of a lens effect of the vitreous, i.e., a lens like condensation of that body, which is capable of a change of curvature and refractive power, by means of suprachoroidal extensions of the ciliary body. The reporter was able to show such condensation of the vitreous, immediately behind the lens in the eye of the ox.

Key observed the case of a man aged 60, who had a combined extraction performed in each eye four years previously, with resulting clear pupillary spaces. Vision in each eye 20/13—2 with the following correction: O.D.+13.50⊂+1.75 cy. ax. 15°. O. S.+12.50 ⊂+1.75 cy. ax. 40°, and with the same combination he reads the finest Jaeger, at 14 inches. The patient habitually used the same glasses for distance
near.

Adams reports an instance of ap
kia in a woman aged 50, with vis
20/25, raised to 20/20 with —0.50.
patient was able to read Jaeger
with a range of two or three in
either with or without a —.50 D.
Twelve years later Jaeger 1 was
distinctly at 14 inches with +1 a
which gave 15/100 at a distance.
thalmoscopic examination disclos
general disseminated choroiditis w
small focus just above the macula.
reporter believes that the patient
have had at least 10D. of myopia
a very small range of accommod
even before the cataract develope

In referring to apparent accomn
tion with aphakia, **Jackson**
greater accuracy of observation
than ingenious hypotheses. In the
majority of cases of aphakia, th
has lost all semblance of accom
tion. Apparent accommodation n
brought about in various ways.
strong convex lens may give a
image of a near object by dra
forward somewhat from its usua
tion; looking obliquely thru a
convex lens materially increa
effect in all meridians, especi
the meridian of obliquity. Agai
is supposed to be the correction
tance may be inaccurate and
somewhat adapted to near
There may be marked differe
refraction between different
the pupil, or a very small apert
give fairly sharp images. Th
to correctly interpret ill focus
ages can be developed to a hi
gree. The refraction of the eye
be changed by external pressu
eyeball. The hypothesis that
the vitreous has a higher ind
fraction than other parts and c
as a convex lens, might be
gated; altho known facts a
be against it. In every case
ent accommodation in aphak
one of the above possibiliti
be investigated. If this were
sufficiently large number of s
the actual mechanism of the

non might come to be understood in every case in which it occurs.

NATURE AND CAUSES OF MYOPIA.—**Edridge-Green** restates and amplifies his former contention that the cause of myopia is not pressure on the eyeball from near work, but heightened intraocular pressure, the result of physical effort; such pressure acting upon the weak point of the sclera about the optic nerve. Special liability of the sclera to give way under pressure, or to be affected by certain diseases, may be hereditary; but this is the sole influence of heredity in the causation of myopia.

The author's argument can be divided into two parts: first, that near work has nothing to do with the production or increase of myopia, and second, that raised intraocular pressure is the sole cause of myopia. Under the first head, he quotes statistics attempting to show that the character of the school has nothing to do with the number of myopes, etc.; and that many children become myopic without having used their eyes particularly for near work. As regards directly exciting causes of increased intraocular pressure, the writer enumerates such diseases as measles, whooping cough and bronchitis. The author holds that the influence of measles is clear and definite in producing sclerotic softening. Physical effort, such as lifting heavy weights, may act by increasing intraocular pressure.

In discussing the mechanics of the raised pressure, the writer observes "that the intraocular pressure rises both when the arterial pressure is increased and when the capillary-venous pressure is increased. Whether the eye will stretch or not when both occur together depends upon the power of the sclerotic to resist the increased pressure. When this is sufficient myopia will not be produced." Again "The obstruction to the posterior lymph channels appears to be the chief cause in the production of myopia."

As regards the prevention of myopia the author recommends avoidance of use of the eyes in a stooping position and the usual hygienic directions, with care during convalescence after those illnesses which produce myopia, and where there is an hereditary tendency to it, to avoid postures and exercises which may raise intraocular pressure. "All exercises should be performed as far as possible in the erect position, with the eyes pointing forward." The writer has nothing to say as to the prevention of myopia by optical correction and regulation of near work.

Levinsohn observes that if most of the hypotheses which have been brought forward to explain the ***nature of myopia,*** have thus far almost completely failed, and must necessarily have been a failure, the cause is to be found in the fact that these hypotheses to a greater or less extent miss the crux of the question. The essential of the problem lies in the anatomic substratum which, as in every other anomaly of the organism, constitutes the most important element in the explanation of the condition. Every theory of myopia which fails to give adequate consideration to the conus, or staphyloma posticum, will never explain the true origin of short sight. To determine the relative frequency of the occurrence of anomalies to be observed at the optic nerve head, the writer has examined a series of new born and older children. He finds that such anomalies do occur in childhood, but in nothing like the same proportion as in adult life, and that such anomalies when they occur, are of very slight degrees—quite small connective tissue rings and coni. The ring of the adult is in the great majority of cases where it is present, an acquired anomaly. The same is almost invariably the case with the conus. Both must be regarded as indicating antecedent stretching of the globe. He considers these facts as quite in accordance with his view that such stretching is to be ascribed in the first instance to the forward bending of the trunk and head.

Haab reviews the early descriptions and pictures of ***staphyloma*** verum in myopia. He gives Galezowski the credit of presenting the first picture of this condition, but his explanation was wrong in regarding it as detachment of the hyaloid membrane. In 1891 Leopold Weiss described this important condition exactly and correctly in Graefe's Archives, v. 23, p. 194. It appears from Haab's review that the nature and importance of the phenomenon in question .was largely misunderstood and wrongly interpreted by the pioneers in ophthalmology.

Kraupa argues that Haab's ascription of priority of discovery and interpretation of true posterior staphyloma to Galezowski is a mistake; such priority actually belongs to the school of Albrecht v. Graefe, as Leber has pointed out. The first mention of it occurs in a paper by Hirschberg in 1876. Kraupa refers also to the writings of others since that period upon that subject. He insists that the real nature and origin of this ophthalmoscopic finding has not been explained even yet. He considers it unlikely that the condition is the result of simple mechanical forces. Various considerations suggest the view that the cause of the phenomenon is to be sought in some abnormality of development.

In summing up the hypotheses to explain the occurrence of myopia, **Junius** holds that neither excessive near work nor Stilling's view, which regards myopia as developed under the influence of muscular action with special form of orbit, nor Steiger's explanation that myopia is an inherited anomaly, are a complete solution of the myopia problem, altho each of these hypotheses contains something of value. In the light of recent anatomic researches, the view that preexisting tissue changes in myopic eyes must be given a place is gaining ground. Such changes are, however, difficult to differentiate from those which follow stretching of the eyeball. Heredity alone is inadequate to account for the myopic process.

Among special disturbances in short sighted eyes are to be mentioned: Early disturbance of the light sense, delayed adaptation, in some cases hemeralopia, thinning, but only at the posterior pole, of the otherwise well formed sclera. These phenomena have all been observed in even the lowest degrees of this anomaly; but no definite explanation of the conus an
staphyloma has yet been offered. Man
circumstances suggest that myop
based upon some predisposition in t
structure of the eyes which can not
classed as abnormal, is truly an
quired anomaly. Light, a physical a
chemical stimulus of the retina, m
become a malign influence in the p
disposed. Ultraviolet rays probal
are injurious to the "dark" appara
(Parinaud, v. Kries) i. e., the rods
their accessories, while the light r
affect the light apparatus i. e.,
cones.

Ashikaga found, in experiments
man, that in bending the upper
of the body the refraction was
creased temporarily 36%, likely du
the increase of blood in the ci
body, causing an increase in the cu
ture of the lens. Furthermore th
traocular pressure was increase
about 16 out of 20 cases, about 0.5
Hg. (in one case 12 mm. Hg.).
author assumes that the myop
caused by increase of blood in th
bital tissues and the eye.

Wernicke from previous experi
maintains that malignant myopi
glaucoma are both manifestatio
one and the same process. Or
myopia is a fault of refraction
and the dangerous myopia refer
is an eye disease and only secon
a fault of refraction. The myopi
ess consists in detachment of t
ina, alterations of the papilla,
and choroid; and scleral ectasia
author compares these manifes
with those of glaucoma and co
that they cannot be separate
them; and thinks that chronic
tism may be a source of the fo
problem can be solved with th
the ophthalmoscope.

Butler reports a case in whi
was 3 D. of myopia, but the vis
only 6/60 in one eye and les
other. At each macula there w
cular area about 1 d.d. in siz
center was depressed below th
level. The circumference wa
and the retina and choroid sh
usual changes. Butler consi
appearance due to myopic s

analogous to hole in the macula. He had seen another case in Jerusalem which developed a deep pit of a green color, with hemorrhage and scars in the choroid.

Chevallereau ascribes myopia to near work which compresses the contents of the eyeball, distending and lengthening the coats, and warns that over 12% of all cases of blindness begin with myopia. He states that myopia is never congenital except in rare pathologic cases.

Blair and **Linn** have examined both objectively and subjectively 1600 pupils of a city public school as to the state of the refraction; they have also made and recorded the results of ophthalmoscopic examination of the fundus in each case. Their investigations confirm the results of previous investigators: That myopia increases directly in proportion to the hours of close application, and that once started, it has a tendency to increase during the school life of the pupil. The authors suggest the segregation of all myopes into classes with a special schedule. This method has been tried and found to be practicable and to work admirably. For the carrying out of this program, thoro examination by a competent ophthalmologist is a prerequisite.

Li's experience convinces him of the necessity for thoro cycleplegia in the great majority of cases. Of a large number of Chinese students examined, 53% were myopic, 36% hyperopic, and 11% showed mixed astigmatism. He ascribes the high percentage of myopia to the peculiar construction of the Chinese characters, writing them being more difficult than reading. Poor hygiene generally prevails among the students.

Rush lists myopia as one of the four chief causes of blindness in China, and states that among students he found 58 percent were myopic.

Gilbert has written on changes in the eye ground in myopia and **Rea** upon extreme choroidal atropy in high myopia as demonstrated with the hydrophthalmoscope. **Schneider** has discussed industrial myopia and **Wiser** has written on school myopia.

Stitzel discusses the subject of myopia from a practical standpoint, making a strong plea for its early recognition by a competent refractionist. Referring to the optician and optometrist, he says it is not uncommon to see cases that have progressed gradually for years under their care, and who only finally consult an oculist after marked choroidal changes have taken place. He also considers the hygienic conditions with the proper lighting of school rooms and work shops where close work has to be performed.

HIGH MYOPIA. **Marbaix** reports a peripapillary hemorrhage in high myopia. The report is illustrated with drawings by the patient, showing the subjective changes during resorption of the hemorrhage.

Kimberlin observed myopia of 16. and 18.D. respectively, in a child 5½ years old. Under full correction and prohibition of school and books vision improved to 5/9 in each eye, with practically no increase in the myopia during the three years the child has been under observation.

Oliver observed myopia of 60.D. and 24.D. respectively in the two eyes. Full correction gives 3/60 and 6/60 vision. Both fundi are normal, with the exception of a very small crescent. The eyes are not unduly prominent, probably indicating a congenital condition of abnormally large eyes and orbit.

Most of **Simon's** cases of high ametropia discovered in military service presented myopia, which ranged from 6 to 20 D., and some with lower myopia associated with nystagmus and other causes for defective vision. He summarizes the views of other German writers upon the importance of such defects.

Eperon sums up the advantages and disadvantage of *removal of the lens* in high myopia—phakolysis. The immediate advantage is improvement of distant vision; the drawbacks are loss of accommodation and immedate and late danger to the integrity of the eye. As is well known, the lesions of high myopia are those of macular chorio-

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retinitis and detachment of the retina. Upon the chorioretinal lesions, phakolysis may have no untoward influence, but it certainly adds to the risk of detachment. Another danger is insidious chronic glaucoma, an event which may occur a considerable time after operation. His conclusion is, never to operate for less than 16. to 18.D., in young persons (under 25 years), in good general health and without grave ocular lesion, and to operate upon one eye only. The operative technic requires special care: All incarceration of the iris must be avoided and particularly that of the vitreous. Discission should be very carefully performed to obviate the dangers of glaucoma, detachment of the retina, and infection of the vitreous. Pagenstecher inserts the discission needle at the limbus; in this way incarceration of the vitreous is less liable to occur, and the operative wound, placed in a region where nutrition is active, cicatrizes more rapidly, thus diminishing the risks of infecton.

Based upon 23 satisfactory results, **Elschnig** recommends the operation for myopia. An initial extension discission of the capsule should precede extraction by 2 or at most 4 days; great care must be taken to avoid prolapse of the vitreous. Almost all of the cases showed decided and permanent improvement of the vision; subsequent detachment of the retina was observed in only a single case. The operation was performed solely upon youthful subjects, but in none under 10 years of age.

Boehm reports the results obtained in extraction of the lens in high myopia; 86% were helped; 13% remained stationary; and 0.7% aggravated. The author does not recommend the procedure in cases with lower than 16 D. of myopia, nor in children under ten years; and it is contraindicated where there is detachment of the retina in the other eye, or absence of vision.

ASTIGMIA. **Stirling** has tabulated the results of examination of 200 eyes (100 individuals), with a view to determining the influence of age upon the direction of the axis in astigmatism; 23 of the subjects were myopic. The average amount of the astigmatism in the plus cases was 0.83 D. The so called "rule," that the axis of a plus lens tends to be vertical, is borne out by his results in young eyes; but in elderly persons they show the opposite. Of eyes under 50 years old, in 15% the axis of the convex cylinder was nearer horizontal than vertical; while in those above 50 it was nearer horizontal than vertical, 75%. Comparison by decades shows a steady increase of the axes toward the horizontal. The author is inclined to think that the change in the direction of the axis is corneal.

In a second paper upon the same subject, the author registered 540 eyes of which 416 were hypermetropic (107 under 50 years of age) and 128 myopic (79 under 50). The average degree of hypermetropia equalled 0.87, that of myopia 1.02. The point of main interest in these observations lies in the apparent rotation of the axis with advancing years, and this seems to apply to myopia as well as to hypermetropia. Thus, of the 107 hypermetropic eyes under 50, 15.9 were more nearly horizontal. Of the 79 myopic eyes under 50 years old, and of the 49 myopic eyes over 50 years old, the corresponding proportional percentages were 68.3 and 36.7 respectively.

Further study shows in both the hypermetropic and myopic eyes a distinctly greater tendency for the meridian of greater curvature to wheel toward the nose than away from it. The author has also found in a few cases changes in the direction of the axis of the same eye in the course of time. As regards the cause of rotation of the axes with advancing years, the author offers the hypothesis that it is to be found in the pressure of the external lateral muscles, especially in such actions as reading. He also raises the question whether the gradual sclerosis of the lens nucleus has any relationship to the changing axis.

Steiger presents statistics of 7,874 astigmatic eyes, of which 6% showed decrease in the amount, 21% no change and 12% increase. He reiterates his conclusions previously published. (See vol. 5, p. 74 O. Y. B.)

Junès advocates testing astigmia with the *stenopaic slit*. The direction of the principal meridians is first determined by the appearance of the lines of the dial with the naked eye. The slit is then placed in accordance with the findings and the degree of astigmatism measured in the two principal meridians in the usual way. The results are to be controlled by cylindrical or sphero-cylindrical lenses before the naked eye.

The corneal curvature in diabetes and other general diseases has been studied by **Gallus** with especial reference to the pathologic significance of inverse astigmia (against the rule). He finds this form increasing in frequency with the age of his patients, and more frequent among them than in other conditions. **Ganguly** reports a case of astigmatism of 11 D. plus axis 20 degrees following cataract extraction. The correcting lens gave vision of 6/12.

Hirano reports a rare case of astigmatism in a patient who received full vision with plus cylinder. She returned later with reduction of vision which was regained with minus cylinders. The author believes that in this case a lenticular astigmia was present.

Barnes thinks that some cases of astigmatism are caused by impairment of the *general health*. Any sickness which directly or indirectly affects the sympathetic and autonomic nervous systems may alter the tension of the eyeball and thereby change its curvature. Chronic emotional disturbances thru the same systems affect the general blood pressure, which in turn influences the ocular tension. Emotional disturbances may also affect the action of Mueller's muscle. The general circulation and health also influence the amount of fat in the orbit. The action of the extrinsic muscles on the curvature of the eye varies somewhat with the extension of the eyeball.

Statistics of 18 cases of comparatively high astigmatism showing the vision attained with corrections determined by atropin, are reported by **Farid Bey**. The Lancet replies editorially to a patient who complains that his headaches had not been relieved by glasses given for astigmatism, altho he had consulted different oculists and they had given him almost identical prescriptions. It is pointed out that the headaches may depend on the vascular system and not on the astigmatism; or, the astigmatism may be irregular and incapable of correction by glasses. Or, if they are strong, looking thru them obliquely may change the effect. Or the correcting lenses if oblique may cause hyperphoria, when looked thru in certain directions.

NOTATION OF CYLINDERS. The report of the council of British Ophthalmologists refers to the absence of any agreed standard for the notation of the axes of cylinders in England and the confusion resulting therefrom. It calls attention to the fact that every mathematic science adopts one and the same notation (commonly called the "Standard Notation") of positive angles, by means of a radius vector starting from the horizontal on the right of its center of rotation, and rotating counter-clock wise to an angle of 180 degrees on the left. If this Standard Notation were universally employed for indicating the position of the cylinder axis, there would be no need for an ophthalmic surgeon to put anything more on his prescription than the angle. (This scheme differs from the one employed in this country simply in the circumstance that here zero is on the left side of each eye and the graduated circle is below. Rev.)

The council considered in detail eight different notations in use and gave reasons for the adoption of one of them: "That in which a similar notation is employed for each eye, zero lying at the observer's left side, and the scale being read below the horizontal with 90 degrees at the bottom and 180 degrees at the right side."

Macleish figures a form of optical prescription blank in which, on an engraved diagram, all possible combinations of sphere, cylinder and prism can be succinctly recorded, and axes and decentration clearly indicated. The diagram does not appear to be constructed upon the usual plan; zero being at the vertical meridian and the 90 degree meridian horizontal for each eye.

IRREGULAR ASTIGMIA. **Magruder** observed a peculiar refractive condition in the crystalline lens, seen on ophthalmoscopic examination as a darker area in the lower part of the pupil, or sometimes in other directions, varying with the position of the examiner. Along the upper edge of this dark area ran a red line which looked like a blood vessel, but which was produced by concentration of the fundus reflex. —1.50 cy. gave full vision.

In the discussion Black thought that the disturbance was in the cornea and represented beginning keratoconus. Crisp believed that the disturbance was in the lens since the corneal reflection of a Placido disc was undisturbed, and also from the improvement in vision obtained by correction. He suggested that the lens condition might consist of a sort of globule or lens within a lens of different refractive conditions from the rest of the crystalline lens.

Shields observed that if the light were thrown obliquely into the eye, the appearance resembled that of a beginning cataract.

In reporting irregular astigmatism due to the lens, **Comberg** speaks of the earlier observations of Donders, Hummelsheim and Gullstrand. Comberg made a study on his own eyes by correcting his hypermetropic refraction and using a cylindrical lens of — 4. D., and looked at small dark triangles on a white background. He saw several pictures of the triangles, as many as five or six at a time, the ones at the ends being most clearly defined. They were not arranged exactly in a straight line and their clearness of outline depended on the position of the axis of the cylindrical lens. This showed that the insertion of a cylindrical lens in the optical system of the normal eye produces multiple images.

This polyopia would appear in all individuals with pronounced regular corneal astigmatism, and Comberg considers this undoubtedly due to the socalled "normal" irregular astigmatism of the lens. To prove that it was not due to the zonule he lay on his back and used glasses that caused tension of accommodation, thus relaxing the zonule so that the lens lay free on the vitreous. The number of images perceived was the same. It is possible that long continued traction by the zonule may cause changes in the form of the lens, and the irregularity discussed is probably caused by the combined action of this chronic traction and irregularities in the growth of the lens fibers. These irregular surfaces are not long radiating lines but irregular round or oval spots.

ACCOMMODATION. **Loeb** discusses the factor which sets the *mechanism of accommodation* in action when an object is caused to approach the eye, and its reversal as the object is made to recede. He concludes that (1) the act of accommodation is caused by rays of light from any point on the object passing thru the perceptive elements of the retina while still converging, or passing in an oblique direction from the periphery towards the center. (2). The amount of accommodative effort is directly dependent on the obliqueness with which the converging rays reach or pass thru the retinal elements. (3). That accommodation itself is an early acquired act, due to the individual learning from his experience, that certain sensations due to converging obliqueness of rays mean that an object lies closer to his eye than their far point, requiring certain muscular efforts to be seen distinctly.

Kletzky calls attention to the fact that the starting point of convergence begins with a divergence of the visual axes, amounting about to 1 meter angle, and not with a state of parallelism. In as much as convergence and accommodation are guided by a physiologic law, namely that of 1 meter angle of convergence of the visual axes to 1 D. of accommodation, how about this meter angle of negative convergence which must be overcome before the visual axes are parallel? He accordingly discusses the possible existence of a *negative element of accommodation* concluding that convergence and accommodation have a common negative starting point, and that the innervational impulse of both functions is binocularly synergistic under normal conditions.

As a convenient form of *accommodation test,* **Duane** has found that a black line engraved on a small white card serves the purpose. He points out the importance of determining the difference between monocular and binocular accommodation, the latter being regularly higher. It is the binocular accommodation that gives, in general, the best measure of the most suitable glass, but the monocular should be tested also in order to discover whether there is any difference between the accommodative power of the two eyes—a fact which may have to be taken into consideration in the prescription.

Feilchenfeld has compared the statistics regarding the power of accommodation by years from 1912 to 1920 inclusive. He finds that for the first two years the percentage having normal accommodation was about 79%. In 1914, 78%; 1915, only 62%; in 1916, 65%. For the next three years it was about 60%, and in 1920, only 54%. This weakening of accommodative power we connect with the various conditions brought about by the great war.

In tabular form **Clarke** publishes statistics of the power of accommodation in 1,400 cases, in which the refraction had been accurately determined, using cycloplegic before 45 years of age. He finds that Donders' tables were incorrect in that they gave the average accommodation as too low after the age of 35, due doubtless as Donders suspected to the inclusion of cases of unrecognized hyperopia. After 35 Donders' average curve becomes practically Clarke's minimum.

Ishiwara has in 306 cases measured the punctum proximum at various ages with his new instrument. He finds that at 10 years the accommodation equals 12 D; at 20, 8.5 D; at 30, 7 D; at 40, 4.5 D. The point passes infinity at 40; the near point at 50. **Erggelet** has written on certain results of accommodation in spectacle wearers.

Oguchi calls attention to the phenomenon that when an emmetrope looks at the full moon, he observes the gradual appearance of a small elevation below or a little to the side, and rarely above. This appearance shows itself equally in a room on a white paper disc (12 cm. wide) when regarded at the distance of 5 meters, but not as plainly as in the case of the moon, nor are the elevations so clear. The phenomenon can be observed more distinctly thru weak convex lenses, and also with convex and concave cylinders. The author is of the opinion that the appearance is due to *involuntary partial accommodation.* In regular astigmatism two elevations appear in the principal meridian, by means of which the direction of the principal meridian may be determined, using the circular disc for the examination.

Weisfelt has studied the influence of *heterophoria,* quite low in the majority of his cases, upon the amplitude of accommodation. Eso- and exophoria were without influence upon the monocular amplitude; in many cases of exophoria larger than 2 degrees, the binocular amplitude was larger than the monocular, probably due to the influence of the stronger convergence upon the innervation of the ciliary muscle. In the lower degrees, no difference could be detected for each eye separately and both together.

Gehreke has written on tonic accommodation with tonic convergent movements of the pupils.

PARALYSIS OF ACCOMMODATION. **Sumner** reports three cases of subnormal accommodation in patients from 24 to 37 years of age; in all chronically diseased tonsils were present, removal of which in the youngest caused an approach of the punctum proximum from 8 to 4 inches. The writer distinguishes such subnormal accommodation from the same condition in neurasthenia and infection. In the former the complaints are apt to relate to the mornings, with improvement as the day wears on; while in the latter, the reverse is the case. The writer has not found focal infection from the teeth and nasal sinuses as a cause of weakened accommodation; infected teeth have usually caused a spasm.

In **White's** case a child with tonsillar abscess, examined three weeks after incision, showed complete paralysis of the accommodation but no paralysis of the sphincter pupillae. Recovery was complete at the expiration of a month under strychnin.

Boulay finds that the most frequent internal ocular paralysis in *encephalitis* lethargica is cycloplegia. It is often unrecognized, may exist alone, but is much more frequently accompanied either by complete paralysis of the iris, or by the Argyll-Robertson pupil, or again by loss of the accommodation reflex. The most remarkable circumstances in the internal ocular paralyses of encephalitis lethargica are, on the one hand, their polymorphism, and on the other, their tendency to spontaneous cure. Boulay reports six different types from the service of Prof. Rollet.

Poulard states that the sudden loss of near vision from diphtheritic paralysis of accommodation subsides in a few weeks, without leaving a trace. Syphilis affects one eye alone as a rule, and there are usually other manifestations of syphilis. In diphtheria the motor neurons of the ciliary muscles are attacked simultaneously by the diphtheritic toxin, but the accommodation reflex is not abolished. A similar condition has been observed in epidemic encephalitis, altho not so pure.

Genet observes that bilateral paralysis of the accommodation without pupillary disturbances is interesting from different points of view, being a matter of general semiology rather than purely ophthalmic, giving certain precise indications in general medicine. The symptom is encountered in a very limited number of conditions only. When present, it limits consideration to a small number of diseases. It also raises the question of the existence of a special center of accommodation, rendering such probable. It has been said to be present in diphtheria only; but while it occurs most frequently in this disease, it is also met with in other conditions in which it furnshes a valuable diagnostic sign, being found quite frequently in encephalitis lethargica, also in botulism, cerebral tumor, and diabetes. Future researches will probably show it to be present in other diseases also, but in the present state of our knowledge, its determination is of great utility in diagnosis, by reason of the small number of affections in which it is known to occur.

Sklarz and **Massur** observed, 3 days following intravenous injection of ½ cm. of caseosan, severe isolated binocular paresis of the accommodation. Notwithstanding a second injection of 1 cm. of the same medicament 4 days after the first, the disturbance vanished entirely at the expiration of a week. The reporters regard the above effect as analogous to absorption of albuminous substances from the digestive tract observed in botulism.

PRESBYOPIA. **Coppez** refers to the inconvenience which *presbyopic hunters* experience in adapting the vision to the sight and bead of the gun while aiming at the game. Correcting lenses are little to be recommended in that they adapt the eye either to the bead and sight, and thus do not show the game distinctly or vice versa; besides moisture, rain, or snow flakes in winter interfere with clear vision thru the glass. To overcome the difficulty Schanz has suggested an arrangement in which the sight of the weapon is placed at the extremity of the barrel; the back of the sight turned toward the eye is provided with a crescentic mirror, the terminal curve of which has the dimensions of the ordinary sight. At the point of the barrel, where the sight is usually placed, is attached an upright in the form of a T. This upright is reflected in the mirror so that the image is formed as far behind the mirror as the distance between the mirror and the upright. If for example the sight and the T are 60 cm. apart, the virtual image of the T is displaced backwards double that distance, 1.20 cm. If the T is 35 cm.

from the eye, the image of the T will be displaced 1.55 cm. from the gunner's eye. In this arrangement of Schanz's the accommodation is suppressed. In aiming the intersecting point of the two bars of the T must be brought to the central point of the boundary curve of the hollow of the mirror, so that the horizontal bar of the T shall be tangent to the edge of the mirror. In this arrangement the indicators of the sight, must be marked upon the reverse face, and in aiming at a target the sight must be at its maximum height.

Coppez calls attention to the following ingenious arrangement recently suggested by Cheval. The latter places a correcting lens with a small diaphragm upon the barrel above the trigger, or between the two barrels. The sight is generally between 35 and 40 cm. from the eye and the correcting glass between 18 and 23 cm. The oculist determines the strength of the correcting lens according to its position upon the barrel and the refraction and degree of presbyopia present. The lens is placed in a metallic cell and provided with a protecting cap.

EYESTRAIN.—**Jackson** observes that asthenopia, being purely subjective, has no objective method of measurement, and that different persons suffer very differently from the same injury or lesion. Such complaints should be carefully attended to by the physician and not simply set down as "hysteric." Among the forms of asthenopia to which attention is called, and which is illustrated by a number of instances, is that of pain produced in apparently normal eyes by exposure to bright light. This frequently comes out with the particular severity in the tropics. A form of asthenopia is sometimes seen in patients suffering from pulmonary tuberculosis. With recovery from the tuberculosis, they become free from asthenopia and may discard glasses upon which they were before entirely dependent. There is another class of patients whose suffering is not relieved by lenses nor correction of muscular imbalance. Careful analysis must be made of the life of the asthenope. Any rehabilitation to be effective must be founded on investigation and inference, going deep and extending far back, and on changes in the habits of using the eyes, or rather the portion of the central nervous system exercised by use of the eyes. Intelligent cooperation upon the part of the patient is required to effect a cure.

According to the British Medical Journal, the London County Council has accepted the view that the eyestrain in cinematograph halls is due to the effort of looking upward at the picture. In some places it has been necessary from the front row of seats to look up an angle of 60 degrees, and the Illuminating Engineering Society committee found that this was the source of strain. The rule has been adopted that the angle shall not be more than 35 degrees but even such an angle is beyond the limits of superduction for many eyes that are normal.

Hanson discusses the fatigue factors incidental to the use of certain optical instruments. **Hill** reviews the ordinary ocular causes of fatigue which he believes to be errors of refraction, muscle imbalance and deficient muscle power. **Kearney** has written on ocular factor in headache, and **Rice** upon headache.

Carson writes upon headaches, pointing out eyestrain as by far the most common source. While a completely satisfactory explanation of such association is not available, the mechanics involved are well understood; they belong to the class of fatigue headaches, and are due to efforts to overcome an accommodation or muscular anomaly. The most common exciting cause of ocular headache is such as requires long continued use of the muscles of accommodation and convergence, i. e., near work. The pains do not always follow immediately, tho they frequently supervene after a certain number of minutes or hours of close work. The underlying ocular conditions are commonly hypermetropia, astigmatism, and muscular imbalance. Ocular headaches are most frequently frontal, fronto-occipital, in the back of the neck, deep orbital and temporal. Headaches are frequently due to a combination of causes, e.g., chronic sinuitis plus astigmatism, removal of one of which alone may give relief.

Lang, himself a sufferer from a *migrain*, recommends hot fomentations to the back of the head when the attack is beginning, or if the headache stage has already begun, cold or iced applications to the same region; the hot fomentations upon the principle that the ocular phenomena observed in the early stage of an attack are directly dependent on a wave of contraction of the cortical occipital vessels, leading first to an impairment and then to a temporary loss of function of the cortex, and therefore to temporary partial blindness. It is further presumed that the contraction of the vessels is followed by their dilatation, allowing excessive blood to the region causing the intense headache and vomiting, so usually associated with increased intracranial pressure. The hot fomentations are applied to cause dilatation of the vessels. If successful in this, the first stage will be cut short and the second prevented. Cold applications are hoped to cause, either directly or reflexly, or both, contraction of the dilated underlying cerebral vessels.

Kahn finds from careful histories that many patients with anomalies of refraction suffer from tremors of different parts of the body. Such tremors are either visible and objective, or invisible and solely subjective sensations. Women are more frequently affected than men. The writer believes the tremors to be due to a nervous disturbance occasioned by anomaly of the refraction. He obtained cure by correction of the error in 85-90%.

Sauvineau holds that hypersecretion is the initial phenomenon and cause of lacrimal affections. The factors at fault in giving rise to such hypersecretion are, first and foremost, astigmatism, followed by hypermetropia and more rarely insufficiency of convergence, whether accompanying myopia or not. He thinks that those who do not agree with him do not know how to measure the refraction—an opinion, he adds, which will not be accepted by the opponents of his views.

McCann writes on the importance of correcting small refractive errors in patients with symptoms of eyestrain. He considers small errors cause more trouble than large ones. Three cases are reported.

Wilder discusses the headaches of ocular origin and considers those in the orbital, frontal, and fronto-occipital regions as from fatigue of the intrinsic and extrinsic eye muscles. Wearing suitable lenses, either constantly or at times for near work, will often relieve this strain. Migrain with the ophthalmic feature of scintillating scotoma, he considers not ocular in origin. There may be, however, some relation between migrain and hypertension of the eyeball.

Brav considers the therapeutic value of glasses as follows: To cure the local or reflex evidences of eyestrain due to errors of refraction. 2. To improve visual acuity, whether due to hypermetropia, myopia or astigmatism, or presbyopia arising from age. 3. To correct latent muscle deficiencies, or to exercise the extraocular muscles in strabismus. 4. To protect the eyes and prevent injuries; and 5, to protect the eyes from injurious light.

AMBLYOPIA AND REFRACTIVE ERRORS.—**Menacho** makes a strong plea, supported by statistics, for improvement of the vision of amblyopic eyes, whether such amblyopia results from failure of the light to reach the retina (congenital cataract, corneal maculae), or coincides with deviation of the organ, strabismus. Amblyopia is due to lack of training. Instead of amblyopia being the primary cause of strabismus, it is the latter which is the cause of the amblyopia; except in those cases where central vision is impossible on account of central scotoma. The cases are numerous where a strabismic amblyopic eye has recovered a useful degree of vision, by exercise necessitated by the loss of the seeing eye. The author reports 11 cases of amelioration of the vision, after correction and orthoptic exercises. He concludes that amblyopias from lack of use include, beside those properly socalled, such as in congenital cataract and strabismus, the entire group of anomalies of refraction. Amblyopia being the consequence of a failure of functional exercise, the latter should be overcome by correcting anomalies of refraction and position of the eyeball and securing the access of light to the retina (removal of congenital cataract, optical iridectomy). To obtain the best results these procedures should be resorted to early.

Fromaget has obtained remarkable results in improving the vision in amblyopia ex anopsia by means of the pin hole disc and a strong convex lens (+ 10D). While the images are more sharply defined by the hole alone, the illumination is so imperfect that nothing is gained with the loupe alone; altho the images are larger, they are so diffuse that no improvement results. The loupe in combination with the hole, not only gives larger images, but augments the illumination by collecting and concentrating the light which passes thru the hole, the lens being placed in front of the disc. Such a combination thus has a three-fold advantage; larger, more accurately focused and brighter retinal images.

Libby observes that careful skiascopic determination of the refraction, with persistence in subjective testing, will often be rewarded by marked improvement in amblyopia. In anisometropia, it is at times possible to harmonize a difference of 6.D, or more with comfort to the patient. Subjects of nystagmus frequently bring objects very close to the eyes. In such cases it is justifiable to use a bifocal lens.

CORRECTING LENSES.—In the selection of the three powers in his *trifocal lenses,* **Spengler** corrects the distant vision with the upper part of the combination, while the ordinary presbyopic correction is given by the lowermost. For the intermediate correction he selects the plus lens, added over the distance correction whose far point will overlap 8 or 12 inches the near point of the distant correction in each eye. He next tries this newly, selected intermediate correction to determine whether its near point will overlap, 4 or 5 inches, the far point of the full presbyopic correction. This intermediate addition is usually about one-half the added presbyopic correction.

The object is to select such an addition for the intermediate correction as will give an equal vision, for 8 or 12 inches of its far point as is given by the 8 to 12 inches of the near point of the distant vision correction. In other words, for a space of 8 to 12 inches the same test type is read equally well with both the distance and the intermediate corrections. If the proper intermediate addition has been given, there will be at least 5 inches of overlapping of the intermediate and close vision corrections, where the same test type can be read equally well with either correction. Spengler has obtained the best results from cemented trifocals by a 30 mm., round, thin wafer. The wafer should be of such a strength, that, when added to the distant correction it will give the intermediate correction. The strength for near seeing should be the presbyopic addition, less the intermediate correction. It must be remembered that the intermediate wafer gives part of the presbyopic addition.

These wafers, when cemented in place, should be of circular form, with the lower segment cut off so that the optical axis of each eye as it moves, will shift on and off the edges of the corresponding wafers at precisely the same instant—a matter of great importance. In cutting distant meniscus or toric lenses, convex lenses should be decentered upwards and concave ones downwards sufficiently to avoid, as much as possible, prismatic aberration, when the eye changes from the distant to the intermediate combination. If preferred, this prism correction may be put in the wafers.

The writer describes his method of placing and cementing the wafers in their respective positions on the distant lenses, and the suitable manipulations as regards heat, drying, etc. The natural standing position of the patient determines the height of the wafers; standing at ease naturally, the line between the distant and the intermediate vision should be 50 feet away on the level floor. The intermediate and close vision division line should be 7 or 8 feet on the floor in front of the patient when standing erect.

Jackson writes that trifocal lenses will probably be found useful in a much wider field, than that to which they have been occasionally put to meet certain special needs. Their fitting raises additional problems for the oculist and optician, which are quite capable of satisfactory solution. For general use probably the dimensions suggested by Spengler are about the best; but they may have to be modified to meet particular needs. Undesirable prismatic effects, whether in combinations of three separate pieces or in invisible form, which latter have been produced in excellent shape in at least three American cities, can be managed about as well as in bifocals.

Using two transitions in the strength of the glass, instead of one, each of the intervals needs to be only half as great in strength; or one can be made even less and the other slightly greater than half, when that is desirable. Even with complete presbyopia, where +3.D. is required to be added to the distance correction, the use of the correction +1.50 for intermediate will give a very useful field, nearly at arms length. Then during the period when presbyopia is coming on, often lasting 12 to 15 years, the intermediate glass will long prevent any region of unfocused images. The third or intermediate field has been found most useful to some surgeons in operating. **Greeff** has written on bifocal glasses.

Sonnefeld insists upon the advantages of *punktal lenses* worn in hookfronts over the distance glasses. He expresses the hope that such an arrangement will replace entirely the lenses for near work; but he fears that the influence of fashion will be too powerful to effect such a reform.

In **Grimsdale's** experience few patients with greatly impaired vision appreciate the larger image for distance given by a *telescopic* (Galilean) combination. For those who require a large image at a considerable distance, such as musicians and those whose professions entail much reading aloud when the page must not be brought too near the eyes, such spectacles are often of great assistance. A frame has been devised to be placed in the front cell of a trial frame over the patient's correction, which allows the surgeon to make a trial so as to gauge the probable value to any patient. The combination chosen permits an eye made emmetropic to read at about 16 inches, with a magnification of 1.5. Minus 4 D. placed in front of the correction adapts the instrument for distance.

Borsch recommends so called "stantoric" lenses, the two surfaces of which are "compensated torics," in which account is taken of the distance of the center of rotation of the eye to the poserior surface of the lens. By the addition of a zirconium salt to the glass, it may be rendered more or less impermeable to the ultraviolet rays.

Von Rohr gives the technic and description of various productions of the guild of Regensburg Spectacle Makers of the year 1600, in modern (German) terminology. For the comprehension of the subject, contemporary sources thus far brought to light are drawn upon. These include the works of Porta 1589, Kepler 1604, H. Sirturus 1618, and Daza de Valdes 1623, together with appropriate citations from other contemporary authors. Some of the above mentioned works are illustrated. The paper takes up the subject of masterpieces, trade rules, such as number of grinders to be employed, questions of competition, etc. and figures, lenses of different kinds and variously mounted.

Kröner describes the improvements in mountings patented in Germany during 1917 and 1918.

Referring to the prismatic effect of *decentered lenses,* **Jackson** observes that if both lenses are decentered equally in the same direction, no harm is done. Thus when reading thru 3.D. convex lenses at 1/3 meter, the decentering of each lens 10 mm. to the right would be balanced by holding the book less than 6 mm. further to the left. On the other hand, decentering that disturbs the relations between the two visual axes must be guarded against. This is especially important in vertical departures of the centers, owing to the slight power of sursumduction. To have one center even 1 or 2 mm. higher than the other, with lenses of moderate strength, may be a cause of serious discomfort.

The decentering of lenses is most commonly useful in presbyopia to lessen the requirements for convergence. Another class helped by the decentering in, of convex lenses, are hyperopes with marked exophoria. Even tho their eyes are suffering from excessive demands on their accommodation, centered convex lenses prove unsatisfactory; because the effort of accommodation being removed by the lens, extra effort is required for convergence. Myopes too, with marked exophoria get great relief from decentering their concave lenses outward. Hyperphoria may be greatly helped by decentering one of their lenses upwards or downwards as indicated or by both combined.

FRAMES.—**Harman** has had constructed a frame with *vertical adjustment* for observation upon hyperphoria. In certain cases of unequal eyes, a false hyperphoria is caused by the prismatic action of the lenses which it is difficult to correct for near vision. In the new frame, one limb is detached and connected by a telescopic arrangement with a rack and pinion, permitting one cell to be shifted above the other. There is a range of 10 mm., sufficient to correct ordinary hyperphoria.

Gould sounds a warning against all eye glasses, considering these injurious to eyes and health because of difficulty of keeping the lenses in proper position. He would abolish all eyeglasses and order spectacles. The following ocular diseases are judged to be caused by ametropia: blepharitis, styes, conjunctivitis, pterygium, all heterophorias, strabismus, epiphora, iritis, keratitis, retinitis and cataract; and he is convinced that the greatest of all, indeed the majority of all lethal and organic diseases have, as their primary stages and original causes, those functional diseases incited by ametropia.

Shastid condemns the use of the "shell frames," as he says it is practically impossible to prescribe for narrow faces, or for wide faces if the eyes are set close together, a pair of 40 to 44 mm. lenses without the pupillary distance of the glasses being greater than the interpupillary distance of the eyes. Another common mistake in fitting spectacles comes from the use of the lens measure. This is practical only for concave lenses, but for thick convex lenses, above 7 D. it is unreliable. Another mistake is confounding degrees with prism diopters; and another, especially in cataract lenses, is to set the sphere in the back cell of the trial frame and the cylinder in the foremost. Attention should be given to refractive errors of muscular imbalance.

Lucanus recommends oculists to pay attention to the frames, to a greater extent than has hitherto been the custom in Germany. He warns paricularly against the modern extra large lenses in presbyopia, recommending instead smaller glasses of 40—38x25 mm. The latter have an advantage in that they permit ready sight over them for distance, so that they can be worn for hours without having to be handled. Hess's forehead loupe—which the writer had constructed in strengths of 5, 10, 15 D., for operation and office use—may be employed with the presbyopic correction, thus furnishing optical means of 3 fold strength. He further calls attention to the frequent occurrence at present of ectopia of the lacrimal puncta in youthful subjects, due to the wearing of the present day nose glasses, which draw the nasal extremity of the lower lid away from the eye.

In the discussion Henker remarked that presbyopic correction of clerical form (half glasses), ground to contain the optical center are decidedly superior to small oval glasses. As regards the frame he was of the opinion that this is not the business of the physician; it is the duty of the optician to select and adapt a proper frame.

Dewey has contrived a spectacle

frame and basket like *arrangement for infants.* The frame has short temple pieces reaching to the temporal region, with a loop on the ends for holding a short ribbon. From this ribbon run three other ribbons which pass around the head to the temple piece on the other side, one ribbon below the occipital protuberance, one slightly above the first, and a third considerably higher. These are joined by several vertical ribbons. With the growth of the infant the attachment of the ribbon at one of the temporal pieces may be lengthened. In this way indentation of the nasal bridge is avoided.

Ocular Movements

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This section reviews the literature of 1921 referring to ocular movements and their disorders. For the previous literature see v. 17, 1921, p. 43.

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DIGEST OF THE LITERATURE

EMBRYOLOGY OF MUSCLES.—As a result of research, **Kiss** states that the eye muscles have their origin in man, as in certain animals, not as has been formerly believed in the sheath of the optic nerve, but directly in the bone. To be sure, they are connected pretty closely with the sheath of the optic nerve, but the author does not believe that an annulus tendinosus is formed. He considers it probable that more extensive research in comparative anatomy will uncover a number of variations in the mode of origin of the eye muscles, but that the principal fact, namely the direct origin of the muscles in the bone, will remain unchanged.

CONGENITAL ANOMALIES.—**Peters** is opposed to Gallus' claim that the abnormal condition of the external rotators of the eye in congenital ocular retraction is the result of a birth trauma. He admits that this may be the cause in some very rare and exceptional cases. He believes that in most of the cases the condition must be attributed to an embryonal defect, especially in cases in which the anamnesis does not give the slightest evidence of an injury during birth.

NERVE TRACTS AND CENTERS.—**Brouwer** supports the opinion that the Edinger-Westphal cell group represents the sympathetic part of the oculomotor nucleus. He considers that the arguments against this Westphal theory are too highly estimated in the literature, and that the nucleus of the elevator of the upper lid is in the frontal part of the large cell, oculomotor nucleus of the same side.

Bilateral ptosis, which, during the last part of life, had been greater on the right side, corresponded to a large disappearance of cells in the frontal pole of the right oculomotor nucleus and in the Perlia nucleus.

It is not so strange that the nucleus of origin of the levator should be in the frontal pole of the oculomotor nucleus, as many investigators have concluded that the nucleus of the superior rectus should be localized in the front part. From the reptiles on, the levator appears to receive its nerve from the branch of the oculomotor for the superior rectus. It can be considered to be split from the superior rectus, a phylogenetically younger part of it, and it is therefore very probable that its cells of origin are in near contact with those of the superior rectus.

Brouwer has examined a case which showed during life paresis of the internus, and found a distinct loss of cells in the Perlia muscles, which he considers to favor Knies' theory, that the convergence center is situated in this nucleus.

Comparatively he found that raphe cells appear in animals when the position of the eyes in the head makes convergence possible. These cells undergo a double change in anthropoid apes and man; they are much enlarged and they have extended more forward. The enlargement can be understood thru the higher significance of the convergence function. The movement forward can be explained thru neurobiotaxis. These cells move in the direction of the Edinger-Westphal nucleus, that is, in the direction of those cells, which serve for accommodation and narrowing of the pupil with the convergence. The Perlia nucleus is therefore nothing else than the phylogentically younger part of the true raphe cells.

OCULOMOTOR NUCLEI. **Munoz Urra** reports an extended histologic study of the nuclei of the third nerves with especial reference to their development. He concludes that this obeys strictly the development of the body in general, and especially of the neuroblasts. The location and extension of the axones is due to the chemotaxis without the intervention of other tendencies, or extraneous and auxilliary elements. The nucleus with its crossing root fibers originates anteriorly to the direct nucleus. The root crossings in the third pair are complete and constant. Complete studies of this nucleus and its development must be made in young animals before the arrangement is masked by the characteristics of the developed nucleus.

An anatomic and pathologic study by **Frank**, in which he attempts to localize the nerve nuclei of the ocular muscles, and describes two unknown nuclei in the human midbrain, should be studied in the original. Frank regrets that Weigert's method has been almost exclusively applied in localizing the oculomotor nuclei. In using Nissl's method he obtained surprising results in the following case of tabes with paresis.

Married workman; eclampsia during childhood followed by exotropia; nervous disorders since 1914, temporarily improved by iodin medication, but aggravated in 1915; admitted to hospital in 1916; diagnosed as tabes with paresis. Clinical findings; left ocular movements normal; divergence in right eye; no adduction; raising and lowering merely indicated; reflexly rigid pupil; no bilateral patellar and achilles tendon reflexes; tremor and ataxia; moderate degree of paresis; aortic insufficiency. Death; April 8, 1917; autopsy performed 2 hours after death; brain fixed in absolute alcohol.

Severe nuclear degenerative changes were found in general as lacunar depressions or degeneration of nerve cells with contraction, chromatolysis, fatty degeneration; likewise vascular changes similar to syphilitic arteritis. Special findings were: severe degeneration of the right, moderate degeneration of the left portions of Darkschewitz's nucleus; severe degeneration of the anterior median nucleus, especially at the right near the Edinger-Westphal nucleus, whose left horizontal and right vertical portions were completely gone. The chief oculomotor nucleus showed typical crossed degeneration, anterior right and posterior left cell groups of its dorsal portion being completely degenerated; its ventral portion showed similar conditions.

Perlia's nucleus showed bilateral severe degeneration more marked in its right, especially the anterior and intermediary portions, than in its left portion. Left Panegrossi's dorso-central nucleus well preserved; right, fairly severely degenerated. Left trochlear nucleus severely degenerated; isolated sections of right trochlear nucleus had severely degenerated, forming white lacunae.

Severe degeneration of the Bottcher-Westphal nuclei, particularly the right nucleus. Crossed degeneration of the posterior raphe nucleus similar to that of the oculomotor nucleus.

With Nissl's method of staining 2 new nuclei was discovered: 1. The subfascicular nucleus, consisting bilaterally of about 30 cells of very variable size and shape. At the level of the trochlear nucleus it starts broadly and runs along taperingly below the posterior longitudinal fasciculus and the posterior raphe nucleus; its distal end could not be determined by the sections. At any rate, it is not identical with Bechterew's nucleus. 2. Wernekinck's intracommissural nucleus, whose cells are scattered thruout the entire commissure of Wernekinck and immediately adjacent to the cells of the subfascicular nucleus. They are large, very uniform, longitudinal or spindle shaped cells, 65 on the right, 35 on the left. Both nuclei showed no degeneration.

On the basis of these findings, Frank makes the following statements concerning the localization of ocular muscles in the nuclear region: Degeneration of the right vertical and left horizontal portions of the Edinger-Westphal nucleus leads us to assume that the fibers of the vertical portion run uncrossed to the ocular muscles of the same side, while the fibers of the horizontal portion run crossed to the ocular muscles of the opposite side. Earlier scholars considered this nucleus the center of pupillary reaction to light. This opinion is contradicted by the present findings of unilateral degeneration with bilateral reflex immobility; on the other hand, severe changes were observed in the central grey matter (Westphal's nuclear group and the posterior raphe nucleus), the region which Bernheimer assumes as the center of pupillary reaction to light. In opposition to Marina, who assumes the ciliary ganglion as the center of the pupillary convergence reaction to the light, induced purely mechanically by pulling the short ciliary nerves when rotating the eyeballs inwardly, Frank—because of unilateral degeneration of the Edinger-Westphal nucleus associated with severe clinical injury (divergent strabismus) to the right internal rectus muscle—holds with Edinger, Bechterew, and others, that the nucleus in question innervates the internal rectus and represents the synergic convergence center for associated movements of the internal rectus and the iridic sphincter.

Concerning the chief lateral oculomotor nucleus, Frank confirmed the grouping described by former scholars of anterior and posterior ventral, anterior and posterior dorsal cell groups, and proves that here we have before us anatomic and functional simplicity indivisible into special centers for individual ocular muscles. (e.g., Dejerine considered the dorsal lateral nucleus as the center for the levators on the basis of findings in a case of congenital ptosis. Yet in Frank's case this nuclear portion was partially severely degenerated, while in a clinical sense the levator was absolutely perfect.)

As a fact, all oculomotor fibers are crossed, not merely the lower fibers. The marked degeneration of the left and particularly the right Perlia's nucleus indicates how closely this nucleus is connected with the external ocular muscles, or rather the chief lateral oculomotor nucleus. The same may be said of Panegrossi's nucleus. For the trochlear nucleus, complete simple crossing has been assumed hitherto. Its bilateral degeneration (more severe in left than in right portion) can be explained only in the sense (already suspected by Zeri, Siemerling and Boedecker) of double crossing of a portion of the trochlear fibers. Siemerling considered the trochlear nucleus as the center of the levators; and its closely connected upper facial nerve was located by Mendel in the distal portion of the chief lateral nucleus.

The possibility is admitted that the chief oculomotor nucleus serves the levator, but since this muscle functioned perfectly in spite of the severe lesions of the nuclear portions in question, there must be an additional center especially for the synergic levator-facialis, or rather levator-orbicularis movements, which center Frank localizes in the subfascicular nucleus he discovered. In another case of bilateral ptosis with paralysis of the superior rectus, severe degeneration of the entire lateral portion of the subfascicular nucleus was observed. Since the medial nuclear portion was well preserved in both cases and extended, moreover, along the pons far into the region of the nucleus facialis, the hypothetic upper nucleus facialis is supposed to be localized here, while the lateral portion—severely degenerated in the case of ptosis only—is considered the secondary nucleus of the levator.

There is probably also a direct anatomic connection of the subfascicular nucleus with the oculomotor, trochlear, and abducens nuclei. Moreover, the discovery of this nucleus strengthens the hypothesis that the posterior longitudinal bundle connects on the one hand the oculomotor and the trochlear nuclei, and on the other hand the abducens nucleus. While the well preserved Boettinger nucleus was not considered to be one of the ocular muscle nuclei, severe changes were observed in the entire central grey matter, especially in Westphal's cell groups and the hitherto very neglected posterior raphe nucleus, whose relation to the Argyll-Robertson pupil should be cleared up by further study. Details about the new intracommissural nucleus can be given likewise only after further research.

Conjugate Movements.—In studying causative lesions, **Holmes** said one must keep in mind the complex physiologic apparatus which regulated the normal movements. They occurred both in response to voluntary impulses, and also as reflex movements excited by peripheral stimuli arising in the retina, ocular muscles, labyrinth, cervical muscles, etc. Some depended on the activity of subcortical centers only, and others required the intervention of forebrain centers. The best known of the latter was in the second frontal gyrus, the motor center for ocular movement, the existence of which had been proved experimentally on animals; there was clinical evidence of the presence of this frontal center in man. It was associated with voluntary conjugate movements, and the paresis due to a lesion in this area might be more or less permanent, while the reflex movements were not affected. There was no proof that this area had anything to do with vertical movements. A second cortical center had been found in monkeys in the angular gyrus, different areas in it being associated with upward, downward and lateral movements respectively, but there was no evidence for an oculomotor center in this position in man.

Paretic deviation of the eyes was occasionally associated with lesions of the occipital lobes which produced hemianopia, but it was not constant and rarely lasted long; and it seemed probable that this efferent occipital system was not concerned in willed and purposive movements of the eyes, but movements excited by visual impressions. It was disease of the brainstem that produced the most complete and permanent, and consequently the most obvious, disturbances of the conjugate movements of the eyes.

The nucleus for the abducens nerve and that for the internal rectus were separated from each other by a distance of 3 cm., but there were association fibers which distributed exciting impulses to the cells of both, and these associated fibers appeared to be situated in the dorsal longitudinal bundle, which formed the associational and reflex paths. The evidence went to show that the origin of these fibers was in a supranuclear center lying orally and slightly ventrally to the abducens nucleus, and that here all impulses were probably correlated and coordinated to produce an adequate response, and the resultant was transmitted to the motor cells. The various fibers belonging to the different functions which converged in this supranuclear center might be injured, a striking example of which was seen in the case when voluntary deviation of the eyes was lost, but the reflex movement persisted.

Disturbances of the conjugate vertical movements of the eyes were more difficult to explain, since the presence of controlling supranuclear mechanisms could not be so clearly demonstrated and their anatomic position had not been definitely proved. But they were forced to the conclusion that there was such a mechanism probably situated in the anterior quadrigeminal bodies.

Loss of upward diviation was usually associated with disturbance of pupil reactions to light, and that of downward movement frequently with loss of convergence and accommodation. These palsies, as in the lateral type might be dissociated, i. e., loss of voluntary movement with reflex movement unaffected.

A pathologic study by **Fremal** throws some light on the *localization of horizontal nystagmus*. He states that Marbury considers Deiter's nucleus as the center from which vestibular excitations are transmitted to the eye. Any affection of the ventrocaudal portion of this nucleus causes horizontal, and disease of its oral portion causes vertical nystagmus. This statement is confirmed by the following case history: A male, 19 years of age, came down eight days ago with temperature, incapability of swallowing and nausea. Clinical findings, first day, paralysis of the soft palate, paralysis of deglutition; morning of second day, second degree of horizontal nystagmus to left, paralysis of the radiales muscles in left arm and of the long muscles in the back; evening of second day, first degree of horizontal nystagmus to right, irregular, its slow component at times very slow, its rapid component frequently irregular. Cold water irrigation produces typical horizontal rotatory nystagmus; 3rd day, death due to paralysis of respiration. Autopsy findings: Serial sections show inflammation of the grey anterior horns of the cervical medulla; in the left the inflammation is more pronounced than in the right horn, and affects the corresponding portions of the medulla oblongata down to the caudal portion of the abducens nucleus. The left portion of Deiters' nucleus is more severely affected than the right, while the left triangular nucleus shows but slight changes.

PHYSIOLOGY OF OCULAR MOVEMENTS.—**Kuile** and **Serkeile** have studied *Listing's Law* in relation to ocular movements. Kuile states that according to Listing's rule, the opposite movement should always agree with the deviation of the right bar from the vertical meridian, for this has been exactly the signification of the opposite movement. The opposite movement proves, however, to be only a partial deviation (about one-half of the physiologically possible movement) of the right bar in respect to the vertical meridian of the large field of vision.

Serkeile demonstrates that during elevation of the eye (A) and a lateral (B) movement, the eye is turned on its axis upon an angle Cos. A: Sin. B., but this rotation is partially compensated for by movement in the opposite direction. $\mathrm{tg.}\,\frac{A}{2}\ \mathrm{x}\ \ \mathrm{tg.}\,\frac{B}{2.}$ These two last values will only be equal in a lateral movement of 90°, which is impossible of execution; in all possible positions the primary rotation is greater than the compensatory. The difference is greatest in lateral movements of 45°.

Post operative fusion after the age of thirty-five is the subject of a paper by **Norton.** The author desires to offer evidence in substantiation of other writers who have dealt with fusion with the belief that age, tho an obstacle, is not an insurmountable one. To present the subject in the most concise manner, the author cites a case of a woman aged thirty-five, who complained of blurring after a concentrated effort at either distant vision or near vision, and headaches daily aggravated by near vision. She remembered double vision in childhood, but didn't remember when it was last noticed. She had alternating convergent squint of about 35 degrees. The visual acuity O.D. 15/10-4; O.S. 15/10-3. The Harman diaphragm showed suppression of either eye. The fields were normal. Atropin was ordered. The atropin examination the following day revealed by retinoscopy +0.25 D. Sph. ⊃+0.50 D. cyl. axis 90° O. U., and a reefing of the external rectus of left eye was advised. Ten days later the advised reefing with advancement, after the method of Harman, was performed. Removing the sutures upon the eighth day after operation, a remaining squint of about 15 degrees was found; consequently any efforts at correction were postponed in order to allow for consolidation of the reef and such cicatricial contraction as might result from the operation.

A desire for binocular vision was then demonstrated by displacing the macular image of one eye with a prism to approximate the macular image of the other eye. By utilizing this desire for binocular vision, twelve periods were devoted to exercising the external recti, and the patient finally succeeded in securing simultaneous vision with the aid of an 8 degree prism, this of course, with conscious effort. A reefing of the external rectus of the right eye was performed. After removal of the sutures this time the phorometer revealed an exophoria of 1 degree and a left hyperphoria of 4 degrees.

A glass correcting 3 degrees of this hyperphoria was prescribed. Simultaneous vision being thus secured, exercises were begun to increase the development of the extrinsic muscles in general.

Four months from the beginning of the case orthoptic exercises were commenced, using a Wells stereoscopic attachment upon a Stevens phorometer, and several series of stereoscopic charts and photographic charts. These latter charts were mostly of the conventional type, with the addition of a few made to stimulate the various stages of logical impulse which would eventually lead to psychic blending without voluntary innervations. The Risley prism was left in position and used for the double purpose of securing perfect simultaneous perception by accurate adjustment, and later piquing the fusion desire by slight displacement.

Up to this time and for five weeks subsequent to it, the patient, complained of the instability of objects, and indefinite sense of flickering, and a subconscious sensation that she was not securing the finished mental picture. Each week thereafter she "sensed" a dawning consciousness of depth, solidarity and distance, different from the makeshift faculty which she had acquired to some extent, and comparable to that which we gain by the constant use of the head mirror, which prohibits the use of both eyes; and nine months from the beginning, she gave complete evidence of psychic blending and fusion in the orthodox sense of the term.

This case represents a series between the ages of 16 and 36 of varying degrees of fault, and what has been accomplished in this series of cases may be accomplished in others.

The author states, however, that a thoro cooperation of the patient with the doctor is necessary, and urges the abrogation of the time worn tenet, that the havoc wrought by fusion desire long unsatisfied is irreparable.

Barrett adds to our knowledge of fusion by the report of a case of voluntary control of the fusion faculty. A. B., aged 28, was referred to him for ophthalmic examination. He was under observation for some mental disturbance with a suspicion of incipient general paralysis. The fundi and media were normal and the following was the error of refraction: R.E., +.50 cylinder, axis 90°—6/4; L.E. +.50 cylinder, axis 130°=6/4. He had binocular vision. He possessed, however, the remarkable faculty of being able to dissociate the two eyes and to cause diplopia by moving either eye outwards, either separately or together. When he fixed with one eye and diverged the other, the deviation was about 20°.

He could not effect any vertical dissociation. He could fix with either the right eye or the left eye and move the nonfixing eye out 20°, or he could turn both eyes out at the same time, each about 20°. He stated that he had been able to do this all his life, and that it was just the same thing to him as moving the hand. He possessed great powers of convergence and could converge to a point approximately five centimeters from the ocular base line. With the trepometer the excursion of the two eyes was as follows:

	Up	Down	Out	In
Right eye	25°	35°—40°	50°	30°
Left eye	25°	35°—40°	40°	40°

This is the only case that he had ever seen in which an individual had voluntary control over the eye movements, to the extent of being able to break the fusion faculty whenever he desired.

In discussing heterophoria, **Maddox** recognizes twelve oculomotor reflexes. Six of these he calls vergences, the two eyes moving in opposite directions. The other six he calls versions, the two eyes both moving in the same direction. Corresponding to each reflex there is a phoria, tendency to turn; and a tropia, actual turning. He divides them into two kingdoms one having to do with the two eyes acting together, binocular vision; the other having to do with turning both eyes into different parts of the field of vision. This classification regarding ocular movements is shown in Table 1.

The subject of the ***monocular perception of depth*** has been studied by **Favange-Bruyel.** The examiner exposes a small coin and in back of this, coins of varying sizes. The subject is asked to say which coin is the same size as the first shown. Some subjects with only one eye select the coin of the same size, and others select coins which are larger. The test is easy for the observer with binocular single vision, but some patients with monocular vision are equally as accurate but slower in making judgments.

Kaila writes on the localization of depth in diplopia. The author does not attempt a detailed empiric explanation of the disparity in depth localization, but only wishes to contribute to the solution of the question in how far depth localization in diplopia can be explained on the grounds of an acquired association mechanism. **Pick** believes it is only in hysteria that the illusions noticed as visual images are seen double. In the literature no exception to this is found, altho many patients have ocular palsies.

DIPLOPIA. **Polliot** has written at length on the projection of images in binocular vision. He believes the

Kingdom I

Motions	Phorias	Tropias
1. Convergence	Esophoria	Esotropia
2. Divergence	Exophoria	Exotropia
3. R. Hypervergence	R. Hyperphoria	R. Hypertropia
4. L. Hypervergence	L. Hyperphoria	L. Hypertropia
5. Incyclovergence	Incyclophoria	Incyclotropia
6. Excyclovergence	Excyclophoria	Excyclotropia

Kingdom II

Motions	Phorias	Tropias
7. Dextroversion	Dextrophoria	Dextrotropia
8. Laevoversion	Laevophoria	Laevotropia
9. Surversion	Anaphoria	Anatropia
10. Deversion	Kataphoria	Katatropia
11. Dextrocycloversion	Dextrocyclophoria	Dextrocyclotropia
12. Laevocycloversion	Laevocyclophoria	Laevocyclotropia

figures used to demonstrate the projection of images in binocular vision confusing. He uses the following figures and eight others to prove his assertion. Line A in figure 9 and line B in figure 10 correspond to what he terms the plane of convergence, which passes thru the point of convergence where the true image is found. The points where the false image lines meet the plane of convergence determine the position of the false images. Figure 10 represents convergence of the visual axes producing crossed diplopia.

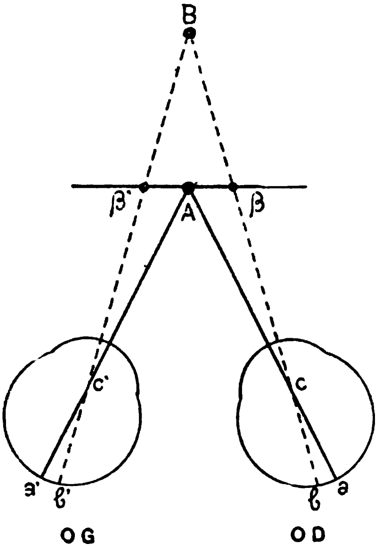

Fig. 9.—Relations of visual axes in convergent squint and projection of images upon the plane passing thru (A) of a point (B) upon which attention is placed. (Polliot.)

In discussing different forms of binocular diplopia, **Hairi** urges that it is wrong to speak of the false images since both are real images formed on the retina. He suggests the name paramacular image for the one which is not formed on the fovea; and instead of speaking of crossed or homonymous diplopia to indicate the direction in which the paramacular image is displaced. This amounts to a statement in each case of the direction in which the affected muscle will turn the eye. He points out some of the difficulties of interpreting diplopia elicited in the ordinary manner by carrying a candle into different parts of the binocular field, and recommends the graphic method of W. R. Hess. He reports a series of observations upon 22 cases of defects of ocular movement marked by diplopia. These are grouped according as the displacement of the paramacular image is vertical or lateral.

Ribas Valero reviews a case of voluntary diplopia. **Santos Fernandez** calls attention to the diplopia seen when one holds his hands before him with his fingers touching at their tips, and fixes some point in the distance. The two sets of fingers seem to have a set of detached finger tips interposed between them, with the right end of the interposed tips belonging to the left hand and the left end representing the right hand tips.

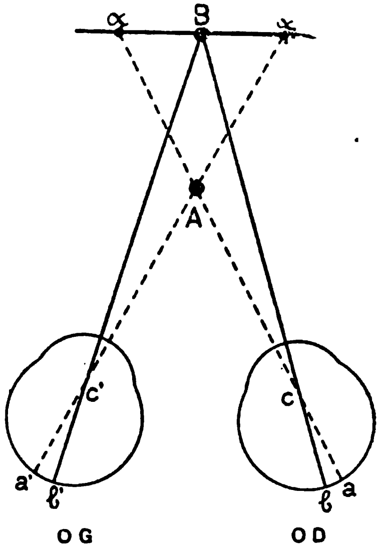

Fig. 10.—Relative divergence visual axes passing thru (B) when attention is directed to (A), causing the crossed diplopia by projection of two images on the plane passing thru (B). (Polliot.)

The *blind spot* in relation to the squinting eye has been studied by **Rössler**. He has found that the blind spot is qualitatively as well as quantitatively situated at a far greater distance from the normal upper point of fixation than in normal eyes during binocular fixation. Whereas in normal eyes the blind spot assumes a definite height (its center being in a radius which makes an angle of approximately 6° with the horizontal plane), in squinting eyes this angle is considerably greater. An exact determination, therefore, of this angle can be utilized as an objective method of examination, and as an index of the precise cause for failure of fusion of the images in both eyes, and proper treatment may be instituted accordingly.

MOVEMENTS IN READING. — **Sheard** writes on the movements of the eyes during reading. His paper is a study of the work of Dodge, Dearborn and Whipple. Professor Dodge developed at Wesleyan University a new and vastly superior method of reading, recording and measuring eye movements in reading. In this device, the cornea of the eye was illuminated by an actinically powerful beam of light, and the moving cornea was photographed thru a narrow slit upon a very sensitive plate arranged to fall vertically at a constant and controllable speed. No inconvenience is experienced by the reader, but the precision is such as to enable the exact location of the fixation to be subsequently located upon the printed page to within an error of one small letter. He showed that the speed of the forward movements averaged about twenty-five thousandths of a second, while the speed of the return movements was of the order of forty thousandths of a second.

Dearborn employed Dodge's photographic method in work carried out at Columbia University, and in 1906 published the latest information there is at hand on the work done by the eye muscles in the process of reading. From this Whipple points out the following results:

1. The speed of forward movements determined by Dodge is confirmed. No reading is done during these movements.
2. The duration of the fixation pauses is, roughly speaking, around one-fifth second. This duration differs with different readers and plays an important part in conditioning their speed of reading.
3. For a line 96.5 mm. long, there were on the average of 7.45 fixations, so that 1.6 words were read per fixation.
4. Fixation is not absolute and constant, but only approximate; in other words, the eye often makes slow gradual changes of position during a fixation.
5. Fixation is not extremely precise with regard to the position vertically along the line but wavers slightly up and down, and these inaccuracies increase, seemingly, when the line is long, the type small or the leading too narrow.
6. The forward jerks may be interrupted by backward movements, regressive movements, or fixation. These retracements are most common at the beginning of a line and in the first few lines of a passage, so that they indicate a preliminary difficulty in locating the left hand margin, which is later on overcome as the eye gets habituated to the mechanical arrangement of the printing before it. It follows that the practice of breaking up the left hand margin of the printing, as is frequently done in primers and readers, is injurious, because it presents an unnecessary obstacle to the work of the eye. There are also occasional movements of refixation, which seem to be due to the eye having run forward too rapidly for the assimilation of meaning.
7. The first and last fixation do generally fall within the edges of the printed page, but this varies somewhat with the reader and with the particular character of the words lying at either end of the line.
8. Fixation is not in the middle of words, but may be practically any place within a word, or in spacing between words, nor does it fall more frequently in the first part than in the last part of the sentence.
9. It is possible to show certain factors that determine the fixating of a given area. Short, connective and nonsubstantive words, prepositional phrases and relative clauses make the greatest demand on apperception, so that lines having many such phrases or words demand a large number of pauses. For some readers, the typography of the line may condition the precise location

of fixation; capitals, dashes, punctuation marks, the socalled "dominating" letters, all tend to hold the eye.

10. Fixation pauses are more frequent than is needed for clear seeing of the stretches read, as is shown by the fact that they remain the same in number when the print is removed to a double distance from the eye.

11. It is possible to be at least vaguely conscious, while reading one line, of the material lying in the succeeding lines.

12. There appears to be a tendency for eye movements to fall into rhythms, as shown by the reading of six successive lines with four fixations each. Dearborn lays much stress on this point. When these rhythmic movements appear, they usually involve also a special manner of distributing time to the pauses, viz., a comparatively long initial pause, followed by two or more short ones of decreasing length and concluded by a somewhat longer pause near the right end of the line.

13. Dearborn said the chief difficulties of eye movements seem to be conquered by the time a child is ten years of age. Others claim that children make many and longer fixations than adults, accompanied by decided uncertainty of movements—refixations, overshooting of the line and the like.

14. The ultimate decision as to the optimum length of the line depends on numerous factors of which eye movements is but one. When the line is shortened, pauses seem to be decreased in duration even tho they sometimes increase in frequency. Short lines develop or favor the development of habits of rhythmic eye movements. The material seen vaguely in lines below that read is more closely connected with the material in attention when the lines are short than when they are long.

15. Fatigue causes a slower rate of reading and a gradual decrease in the velocity of eye movements.

16. Problems of speed may be approached by comparing the performances of fast and slow readers. Fast readers evidently drop more reading into rhythmic eye movements and make fewer and shorter stops.

STEREOSCOPIC VISION.—In a paper, "The Stereoscopic Appearance of Certain Pictures," **Blaauw** criticises Edridge-Green's article in "Nature," November 18, 1920, page 375. Edridge-Green claims that the perception of binocular relief is independent of double images of the two retinae similar to those which are presented by an object in the field of vision. He illustrates his argument by taking a pair of stereoscopic photographs in which the point of sight is at the center of each and cutting them vertically in two; and then, having pasted the left half of the left photograph on the left side, and the right half of the right photograph on the right side on white or black cardboard at an appropriate distance, so that there is no overlapping when placed in the stereoscope, a picture in striking relief is obtained when combined together in the stereoscope. In this case it will be noticed that there is no portion common to both fields of view. In each case the overlapping portion is combined with white. He says it seems probable that this is how binocular vision takes place in ordinary circumstances. If an object in high relief, a vase or the face of a person, is viewed at a short distance and one particular point fixated, it will be noticed that the right eye dominates the right side of the field of vision and the left eye the left side, as may be proved by noticing the relation of surrounding objects, and closing first one eye and then the other alternately.

Edridge-Green says stereoscopic vision is an abnormal binocular vision, and is not the same as perception of depth. One sees thru a pair of positive lenses, which are combined with adducting prisms. The positive lenses replace the lenticular accommodation, so that a clear perception can take place at the focal distance of these lenses (usually at about 20 centimeters). The adducting prisms help in bringing the visual axes in a parallel position.

In the effort to bring the visual axes in parallelism, the two images seen with the right eye are projected to the left and the two seen with the left eye are projected to the right. One first sees four pictures. If stereoscopy takes place, the right image of the right eye will come together with the left image of the left eye, so that only three images are seen, the middle of which shows the stereoscopic effect. This happens for the "free" stereoscopy. In using the instrument one notices only the middle picture, as the partition between the lenses which projects forward excludes for each eye the outward picture.

In repeating Edridge-Green's experiment, all that is necessary is to cover the middle part of the photograph with a piece of paper. Such a stereoscopic picture put in the instrument will undoubtedly show a stereoscopic effect, but this is the result of the pictorial arrangement, and shows that stereoscopic effects may be obtained without fusion of two nearly similar impressions.

Edridge-Green cannot prove his position with the pictures which demand synthesis, and these are the only valuable ones for proving the stereoscopic impressions. Any opinion which questions the fact that the right visual field partly covers the left one and that this produces in the brain the fusion of these impressions, which becomes exteriorised as "the perception of depth" is an absurdity. If Edridge-Green's opinion were correct, there would be no difference between simultaneous vision and the socalled stereoscopic vision.

Blaauw refers the reader to an article of his own, "Binocular Single Vision," in the transactions of the Section on Ophthalmology of the A. M. A., 1917.

Sheard speaks of the study of stereopsis as a desirable routine test. For two or three years a series of experiments has been carried out upon the matter of the ability of a normal pair of eyes to distinguish a depth distance. The binocular parallactic angle is absolutely essential to any refinement of this faculty. For the safety of the public, aviators, chauffeurs, engineers, motormen and other motor drivers should be tested as to this matter of stereopsis.

Von Szily believes the appreciation of stereoscopic images of the projections of shadows can best be explained on the theory that there must exist a special natural sense for tridimensional visual perception. This, according to Hering, is a phylogenetically acquired property of the function or sense of vision, similar to that for binocular depth and object vision. Altho this tridimensional sense of vision is inherited, individual experience teaches that, in order to enable one to make good use of it, it must be developed by practice. This is the reason why visual perceptions of shadow projections are so much better appreciated by individuals who by constant practice had developed this sense to a greater extent than those who have not done so.

Diaz-Caneja has experimented with stereoscopic vision as observed with the "Bitumi" of Zeiss. Helmholtz, describing the stereoscopic microscope of Nachet, said that it allowed of two images and that the instrument divided the light, sending half to each eye. This, however, is entirely different in principle from the instrument of Zeiss, the "Bitumi." The stereoscopic problem of the "Bitumi" is in reality the fusion of two unequal images, or, in other words, fusion into simple vision, of two points of disparity on the retina. To appreciate the "relief" of an object it is necessary to perceive the planes presented and to allow our visual line to act as the stick which guides the blind man. If we have to draw near or put away our fixation point, in using the "bitumi," it is proof that the object has different planes and offers a distinct relief. It is important in using the "bitumi" that the eyes preserve their parallel axes. In analyzing stereoscopic vision, it must be stated that the visual space is a practical, but not exact, representation of real space. We have not only to see, but to interpret. Microscopic vision with the "bitumi" is obtained with the use of both eyes, without using the stereoscopic diaphragms, and bearing in mind that the stereoscopic vision obtained may not correspond in reality to the spacing of the object.

DISSOCIATED MOVEMENTS.—**Rumbaur** records a case of voluntary dissociation of bilateral ocular movements in a healthy girl of sixteen years, who claims to be able to squint voluntarily. She can look straight ahead with either the right or left eye and yet put the other eye in extreme adduction. While one eye is thus fixed in isolated adduction, the other eye can be turned horizontally.

Innervation of adduction is accompanied by narrowing of the pupils and marked accommodation of both eyes. The associated eyes are otherwise freely movable. There is very slight esophoria, 2° compensated by glasses. Bilateral visual acuity 6/6. Voluntary dissociation of ocular movements is very rare. Wilbrand and Saenger report five cases associated with congenital ambylopia of one eye, ametropia and heterophoria. Rumbaur's case shows, however, no symptoms of severely disturbed balance. If Bielschowsky is correct in assuming that the subcortical centers for isolated ocular movements are inhibited from cortical centers regulating associated movements, then Rumbaur's case testifies not to an abnormally strong innervation impulse, but rather to a voluntary inhibition of normally associated innervation. (See also p. 68).

Köllner states that in testing the localization of the direction of a far object in peripheral vision with one eye only, and in marking the localization on a board near the eye, localization is observed as not occurring in the sense of the cyclopic eye; rather is there a very characteristic difference between the temporal and nasal halves of the field of vision. In the temporal half the localization of direction corresponds fairly accurately to the connecting line between object and eye, while in the nasal half an error in localization is regularly made in the sense of localizing the object too far over in the direction of the unseeing eye. By modifying the test arrangement the following law of localization may be stated. In the temporal half of the visual field the localization of direction always corresponds to the actual position of the image formed on the retina; but in the nasal half the localization of direction is given as tho the image of the object were formed in the corresponding retinal spot in the other eye, if this eye were also focused on the fixation point. Tests made with reliable observers, for the various test arrangements, yielded results in most cases which were almost identical with the mean of the localization error calculated by this law.

The law may also be stated as follows: In the right half of the visual field localization is always determined by the position of the right eye; in the left half of the visual field it is always determined by the position of the left eye, it being immaterial which eye observes. A visual impression transmitted by the uncrossed tract of vision is judged by the brain as tho transmitted by the crossed tracts from the corresponding spot in the other eye.

These results confirm Köllner's earlier statement concerning the preponderance in a common visual field of impressions of the temporal halves of the visual field. The law of localization provides new aspects for testing the habits of the one eyed. After enucleation of one eye, the normal method of localizing, with its characteristic difference between both halves of the optic field, is retained for some time until the disappearance of the error in localization from the nasal half of the retina finally testifies to cerebral adjustment. This adjustment seems to set in at various periods in different individuals; as a rule it occurs after 4 or 5 years later. It is probable that this law will provide a simple method of determining and registering the final habituation to monocular vision.

Ruggeri gives tracings of the pulse showing the marked effect under certain conditions of extreme convergence of the eyes. This is accomplished by having the reclining patient gaze at the forefinger held 1 cm. from the tip of the nose. The pulse was not affected or was increased merely by three or four beats in the numerous normal subjects tested. But in five patients with polyneuritis from malaria, diphtheria or influenza, the pulse ran up at once by twenty or thirty beats; in five with thyroid dysfunction the increase was from twenty-five to thirty. The findings were negative, the pulse growing slower, in bradycardia of vagus origin and in four cases of the Bernard-Horner syndrome. In three cases of pulse alternans, the response was negative in two cases, but positive in the third case which soon terminated fatally.

ASTHENOPIA.—**Hazen** states that the pathology of asthenopia is to be found in the muscular system of the eye, especially in the extrinsic muscles, which are the controlling apparatus of binocular vision; this taken together with the focal apparatus constitutes a distinct function. Man has added to his capacity to see monocularly, the perfection of binocular vision. These conclusions have been arrived at from a study and treatment of over 200 cases of muscular asthenopia during a period of twenty-five years.

These cases have been treated solely by orthoptic exercise, the instrument used having been invented by the author and called the "Hazen Kratometer." In a high percentage of the disorders of the muscular system, there is associated with it inflammation of the tissues of the eyeball and lid. Hyperesthesia of the retina is a common condition, associated with other symptoms of asthenopia. This condition is also due to muscular asthenopia.

DEVIATION OF THE HEAD.—**Marbaix** has observed such deviations in astigmatism, ocular palsies, or insufficiencies following tenotomy, ptosis, grave diseases of the brain, and nystagmus. He cited 6 cases: (1) Myopia of 2 D. in the left eye. For three months the head has been carried to the left, the eyes to the right. The left eye in adduction. This is contrary to the rule that the better eye is placed in adduction. (2) Deviation of the head to the right eye and both eyes to the left in connection with functional insufficiency of lateral movements to the right. (3) Right eye enucleated at the age of 18 months. Left eye in adduction, head to the left thru preponderance of the internal rectus over the external rectus. (4) Amblyopia of the right eye. The left eye, very hyperopic, is in adduction. The head turned to the left. After atropinization and correction of the hyperopia the head is held straight. (5 and 6) Lateral deviation of the head in nystagmus and good vision. The nystagmus is almost arrested by convergence. For distance, deviation of the head and adduction of the eyes. With one of these patients the wearing of prisms of 10° apex to the nose allowed keeping of the head straight in nystagmus.

HEADACHE AND VERTIGO.—**Grandclément** gives the characteristics of headache of ocular origin: (1) Continuity—short periods of relief, never complete. (2) Localization—in half of the cases the acute localization is the region around and between the eyebrows, then, in order of frequency, the vertex, occiput and temples. (3) Their relation to visual work—the troubles of refraction constitute the most frequent cause; most often one finds astigmatism and hypermetropia, rarely myopia.

The headaches are the consequence of exaggerated accommodation. The troubles of convergence may be a cause, but much less frequently. The patients generally have normal visual acuity.

Vertigo seems to be much less frequent than headache. The author reports two characteristic cases; in the first patient the vertigo was due to an effort of exaggerated accommodation in a person with pronounced hypermetropia; in the second it was the consequence of inadequate function of convergence. The vertigo often accompanies the headaches, but it may appear alone.

PAST POINTING.—**Kiss** found that under normal conditions, there was always past pointing when the eyes were forcibly turned to one side, and the direction of this usually corresponded to the direction of the eyes.

DIAGNOSIS.—PRISMS.—**Buchanan** has compared two methods of applying prism tests. The first method is to begin with a small prism and gradually increase its strength until diplopia is obtained. This is the ascending method. The second is the descending method. Begin with a prism of sufficient strength to produce diplopia and decrease its strength until binocular vision is restored.

The apparatus used was a de Zeng phorometer, a Maddox rod, and a 7 mm. spot of light. The subject's age age was recorded. His near point of convergence was taken and his near point of accommodation for each eye separately, using the Duane disc and the Prince rule. His usual acuity was measured with the Snellen test letters. If the subject wore glasses his correction was worn during the experiment. The phorometer was placed 6 meters from the spot of light at the level of the subject's eyes and adjusted for the interpupillary distance. As the Maddox rod attached to the phorometer was too far from the subject, a rod from the trial case was placed in the cell nearest the left eye.

To measure the muscle balance and prism convergence for near, a small spot of light was held at a distance of thirteen inches. The convergence was determined by the ascending and descending methods for both eyes; associated with phoria there should be corresponding changes in prism convergence and prism divergence. Whenever there is a great difference in the closeness of agreement to such a relationship, shown between the ascending and descending methods, the descending has the advantage.

Wells describes Cohen's apparatus for measuring binocular perception of depth. (See v. 16, p. 8.) He thinks that visual tests will not stop with measuring the acuity of each eye and other simple tests, but that a certain standard of stereopsis will be required of engineers, chauffeurs, motormen and the like.

Cantonnet suggests methods for the detection of tendency to squint. When the tendency to strabismus is slight, it may be difficult to recognize it. A simple test, that can be applied even to the youngest infant, is to hold a light, a candle or burning match, about 80 cm. from the child's eyes, on a line with your eyes. Looking into the child's eyes, the reflections of the light will be symmetric if the eyes are normal. Otherwise, the abnormal location of the reflection in one of the eyes will show the strabismus and its type. The possibilities of variations in the angle alpha must be borne in mind.

As the deviations of the eyes are generally not tested with sufficient accuracy, **Ohm** devised a new tangent screen which has the advantage over Hirschberg's that it can be used from both sides. The screen is described in detail and with it the analysis of diplopia in cases of traumatic enophthalmos, spasm of convergence, nystagmus and strabismus.

Baldino describes an apparatus for the determination of heterophoria. The apparatus is based on the "hole in the hand" experiment. It is somewhat similar in its use of this idea to the device proposed by Cantonnet. It consists of two tubes 20 cm. long, resting on a horizontal bar, which is supported on a tripod. Both tubes are movable in any direction, and can be twisted on their long axes, each movement being recorded on a scale reading in prism angles. The distance between the tubes is adjustable from 40 to 70 mm.

The chief advantages claimed for this over Cantonnet's apparatus and other devices are: 1. It determines all forms of heterophoria directly in prism angles. 2. Serves for distant and near tests. 3. Measures cyclophoria. 4. Aids in examining the muscle balance in the upper, lower and lateral fields. 5. Has an adjustable base line.

In a cheap but satisfactory substitute for Prince's rule the modifications suggested by **Duane** are: 1. The removal from the rule of the scale of ages which was not in accordance with the realities and was of little service anyhow. 2. A finer graduation at the distal end of the scale (into eighths and quarters of diopters). 3. Placing the zero point at the proximal end of the scale but about a quarter of an inch from it, so that when this mark was placed, as it should be, at the anterior focus of the eye (practically at the plane of the patient's glasses), the end of the scale could rest against the cheek.

Gros has devised a rhythmic obturator which may be used in connection with a stereoscope or takes the place of the hand in passing quickly from alternate fixation to binocular vision.

Escribano experimented with Remy's *diploscope* and states that with this apparatus, stereoscopic vision is obtained, altho with greater difficulty, the further one looks. The author presents a modification to secure this vision at a distance.

Black presents an apparatus for the use of a light for *testing muscle balance* which he has employed for several years. This apparatus consists of a de Zeng hard rubber ophthalmoscope handle with a detachable cord, a lamp and the transillumination cap. At about the middle of the latter a one-half millimeter hole is drilled, and directly opposite a one millimeter hole. The handle is attached to the slide on the card holder of the optophorometer by a clip and set at 33 mm. from the eyes, and the balance of the lateral and vertical muscles tested in the same manner as in the distance. This use does not interfere with the transilluminator being used for its normal purpose, or for oblique illumination.

The same apparatus is used for the distance, only the cap has a solid top so no light will be thrown on the test chart to which it is attached and the hole is 2 mm. in size. It has been found that much more accurate estimation of the degree of heterophoria is obtained with a small spot of light than with a large. With a 10 mm. spot of light, an error of from 1 to 3 prism diopters has frequently been observed with the average patient, who, as is known, is not a careful observer. The determination of abduction, adduction and circumduction with the small light is much more quickly done, and is more accurate.

Harman describes a trial frame with *vertical adjustment*. In 1910 he showed a pattern of ophthalmic calipers, one limb of which gave a T square with a vertical scale adapted to measure the decentering, when the trial frame is tilted to carry the lenses of one side up or down until the required balance is obtained. Tilting the frame has the disadvantage of putting cylindrical lenses out of focus, so that accuracy of balance can not always be obtained. To overcome this difficulty, the author has had a trial frame fitted with unilateral vertical adjustment. The frame is of the Moorfield's pattern with the usual facial, lateral and vertical adjustments worked by screws. To the limb which carries the lens cell of the left side a separate vertical adjustment has been fitted. The limb is telescopic and worked by rack and pinion, so that the lens cell can be moved vertically upwards or downwards 5 mm. each way. The vertical displacement of the lenses necessary in any case to obtain an even balance of the eyes may be read off from the scale engraven on the telescopic limb.

Onfray in 1920 and again in 1921 writes on the examination and treatment of patients with strabismus, stating that as long as there are children who have strabismus, so long will the study of strabismus be inexhaustible. Children thus affected may be divided into groups; those who can recover binocular vision, and those in whom only the deformity can be cured.

After a detailed discussion of the conditions of normal binocular vision, the author passes to the examination of those afflicted with strabismus. There should be three stages in this examination: the first examination is made without any previous preparation. The visual acuity of each eye and the deviation are carefully noted. The second examination is made a week later, after eight days of instilling atropin. At this time the refraction is corrected, difference of acuity and angle of deviation are more exactly noted, and the parents are told to keep the eye which is usually used for fixation covered for a week.

In the third examination should be noted: 1. The equivalence or difference of the perceptions of each eye. 2. The state of inequality of the muscles, spasmodic as well as paretic. 3. The presence or absence of an aptitude for simultaneous vision or for fusion of images.

Indications for treatment depend upon the peculiarities of the individual case. He also enumerates the reasons for treatment of convergent strabismus by glasses at the age of 3; functional exercises at 8, and surgical reenforcement of the abductors at 10, if correction is not realized before.

An early diagnostic sign in basilar meningitis has been found by **Gingold.** The author reports a case illustrating this diagnostic sign of early meningitis and calls it a "reflex" strabismus. It is elicited by flexing the head on the chest. When this is done either a bilateral or unilateral strabismus develops which will last as long as the head is kept flexed and disappears as soon as the head is relaxed. In many cases the strabismus is accompanied by a retraction of the upper eyelids. In some cases there is a contraction of the pupils. During a period of seven years of observation, "reflex" strabismus was present in the early stages of almost every case that came under observation. In the late or paralytic stage, flexion of the head fails to produce strabismus. By means of this sign basilar meningitis may be diagnosed days before any other symptom of meningitis appears.

AMBLYOPIA EX ANOPSIA.—**Poulard** has studied the question of amblyopia ex anopsia and concludes that there is no true amblyopia from disuse. Among infants affected by strabismus, some have good vision in both eyes, others have amblyopia in the strabismic eye. The poor vision is considered a consequence of strabismus when no demonstrable pathology can be found. He has never seen or heard of a patient whose vision was known before the eye deviated who developed socalled amblyopia ex anopsia. We all know well the existence of congenital amblyopia without visible fundus lesions but we are loath to admit the diagnosis in patients with strabismus. It is probable that no one has ever developed vision in a strabismic amblyopia. There are two important things to be gained by solving this problem, one scientific, which would be satisfied by casting aside a false idea, the other practical in that time and trouble would be spared the parents and children by eliminating useless exercises. [Compare this statement with **Worth's**, vide infra.]

Juler thinks that more light might be thrown on the subject of amblyopia from disuse by evidence which gave more exact definition or determination of dates of onset, than was obtained from ordinary strabismus cases. He thought that in certain cases of injury to the lens in young children, a line of evidence might be obtained which would satisfy the disputants; and perhaps decide whether amblyopia from disuse exists or not.

Even in cases where an artificial pupil had been made, the deviation of images by the aphakic hypermetropia must be so great that the retinal impulses could not compete with or assist those transmitted from the retina of the sound eye, and one would expect these impulses to be neglected, with the consequent development of amblyopia from disuse, if such disease exists. The latter should still more certainly develop if an opaque lens or membrane blocked the light path for some considerable period.

He had been able to trace a certain number of the juvenile traumatic cataracts recorded in the Moorfields Hospital notes from 1910-17, to see them personally, in many cases to form a new pupil, and finally himself examine the vision, fundus, and other points in every case quoted. He found a striking line of difference between the final visual results, depending on the age at which the lens became opaque. None of the eyes which became cataractous before the age of 5 had retained a final central acuity of vision of 6/60. The series gave evidence that there is such a disease as amblyopia from disuse; that it affected the eyes of children up to 6 years, that it did not attack the eyes after the age of 7 years, that it was not merely a standing still of the development of the retina, or of certain cerebral associations, but that it caused a real retrogression of the effective power of the retinal impulse on the consciousness, after the macula had reached an age at which a central vision of 6/6 was normally present. The existence of amblyopia from disuse as the result of concomitant squint had been the subject of dispute among ophthalmologists for the last fifty years.

By experimentation **Delord** has attempted to ameliorate the amblyopia of the deviating eye in strabismus. The results were unsatisfactory, but he is able to record 35 observations in which the amelioration was marked. First it must be an amblyopia without lesions. All his cases had strabismus; all were children from 4 to 9; above 10 he had not found it possible to ameliorate the visual acuity because the patient would not support occlusion of the good eye. The best results were obtained in children from 5 to 6. For an occlusion he uses an opaque glass covered with an opaque material that projects beyond its edges, and assures an absolutely perfect occlusion, and the frame is worn constantly. The refraction is exactly corrected, and during the first weeks atropin is used in the healthy eye. Cure has been permanent in cases he has been able to follow for some time, some of them for 15 years. There must be cooperation of the parents and frequent examination by the oculist.

ETIOLOGY OF STRABISMUS.—**ten. Doesschate's** investigation of the etiology of concomitant strabismus showed that the difference between paralytic and concomitant strabismus was not very distinct, and that in most cases of concomitant strabismus some qualities of paralytic strabismus were present.

The author gave an account of his findings with regard to the fields of fixation in the horizontal meridian for divergent and convergent strabismus; and from them concluded that compared with the normal, the field of fixation in convergent squint was somewhat enlarged toward the nasal side and constricted toward the temporal side, especially in the deviating eye; while the reverse was true for divergent squint.

In most cases of concomitant strabismus, the primary and secondary strabismic angles, contrary to general opinion, were not alike, altho the difference is sometimes quite small. During the onset of strabismus, double images are observed much oftener than is usually mentioned. This is true even in young children. It is known that patients with paralytic strabismus often have difficulty because of their defective orientation. However, in concomitant strabismus also very peculiar localization disturbances are observed.

It appears from the foregoing that in many cases of concomitant strabismus, most of the peculiarities of paralytic strabismus are present. Since many cases of squint, which started with paresis, gradually display a true concomitant type, and since all possible degrees between the two forms appear, a formal division between the two should in general be given up and the cause of the one disease should be accepted as a cause of the other also. **Fernandez** attributes the development of strabismus in a child 9 months old, to a long, fast automobile trip while he was teething.

Rivers in his book, Three Clinical Studies in Tuberculous Predisposition," maintained that squint was about three times commoner in consumptives, and probably also in consumptives' parents, than in the nontuberculous; that such squint seemed to favor the left eye, and that tuberculous squinters were left handed, and gave a family history of left handedness oftener than did nonsquinters. From further study he asserts that squint is commoner in children than in adults. Squint is excessive in lung tubercle and in lymphatic gland tubercle, but not in bone and joint tubercle. Squint is excessive amongst the clinically nontuberculous mothers (at any rate) of nonsquinting consumptives. Left eyed concomitant strabismus is somewhat associated with mancinism and with a family history of mancinism whether in phthisical or in nontuberculous subjects. To say that tubercle causes squint is inadmissable because the squint always was found to have appeared first. Bone and joint tubercle cases are not free from tuberculous ocular complications. Photophobia seemed commoner in these cases.

Tuberculosis in the insane is frequently accompanied by squint. Squint is a mark of general tendency to abnormality. Very few working class children are cured of squint, and an undue proportion are destined to become inmates of asylums or prisons. An undue proportion become tuberculous, or the mothers of the tuberculous, and among them the mortality is high. In order to avoid the confusion inherent to calling all cases strabismus, **Martini** points out that the form due to alterations of binocular vision might be called *"strabosis,"* while strabismus, altho it constitutes the more visible expression, is not the absolutely exclusive expression of the functional disorder.

TREATMENT OF STRABISMUS.—**Deloge** concludes that owing to its double nervous and optical origin, convergent strabismus requires a treatment that is long and particularly delicate to establish, but in which reeducation of binocular vision is essential. Where possible this constitutes the preferable method, as well as the indispensable complement to surgical intervention. We should beware of the opinion of a great number of excellent ophthalmologists who believe divergent strabismus can be relieved only by surgery. With a few reservations we hold the contrary to be the truth, and it is chiefly in these cases that orthoptic treatment gives the best results. **Cillereulo** writes on the operative treatment of strabismus; **Inouye** on acute strabismus and its therapy; and **Marquez** on the operation for strabismus.

Cantonnet asserts that squint can be corrected by training vision alone in cases of divergent strabismus and in the very mild and recent cases of the convergent type, if the child is young and intelligent and cooperates. All others require an operation. **Cuvillier** makes the subject of a thesis, deviation in strabismus. **Lewis** reports an internal squint of 45°. According to **Worth** the treatment of convergent strabismus includes: (1) the prevention or cure of amblyopia ex anopsia; (2) the correction of the refractive error; (3) fusion training, and (4) operation.

If a constant unilateral squint had lasted a considerable proportion of the child's life, in the absence of efficient treatment the deviating eye would be found to be more or less blind. Probably no one now doubted that the amblyopia was almost invariably acquired from disuse, and the loss of sight was more rapid the younger the child. One who began to squint constantly at the age of one year might lose central fixation in three to four months. The child must be forced to use the deviating eye; that was far more important than all the rest of the treatment of squint.

In a recent squint, to cure low degrees of amblyopia, or prevent it, the fixing eye should be kept under atropin until it became the deviating eye. The child should then be seen again after the effect of the atropin had passed off. After this, the deviation must be kept alternating, one or other eye being atropinised occasionally if necessary. If central fixation in the deviating eye was absent or unsteady, the atropin treatment was not sufficient. Then the fixing eye should be continuously occluded; intermittent bandaging was of little use.

With regard to correction of refractive error, no child was too young to wear glasses if they were required. As to fusion training there were certain principles which must apply to all methods. The child must be young, preferably under six years of age, and the sight of the deviating eye must be good. A device should be used for throwing pictures simultaneously upon the macular region of each eye. The most difficult step was to overcome the suppression. A good way was by unequal illumination of the object slides in whatever instrument was being used, and the interest of the patient must be maintained during each lesson. The object of fusion training was not to correct the deviation, except in small degrees, but to enable the patient to see binocularly when the visual axes shall have been restored to approximately their normal relative directions.

With regard to operation, if measurements showed that the angle of deviation was increasing, or was not decreasing, operation became necessary. If there was no hope of binocular vision, he did not, usually, operate until the 7th or 8th year of age. Formerly, he frequently performed tenotomy of the internal rectus, in combination with advancement of the externus in high degrees of convergent squint, but this practice was finally abandoned by him in 1905. Many of the cases had been followed by divergence long afterwards.

For many years the author has been relying on advancement alone, and, except in very small deviations, both externi were advanced. He proceeded to enter into the minutiae of technic, concluding with the remark that there were practically unavoidable failures in squint operations; the result attained was a measure of skill and experience of the surgeon, who should be prepared to accept the responsibility for it.

Hoorens, in order to determine the results of early functional treatment of strabismus, examined the records of 322 patients with convergent strabismus, who in most cases were greatly improved by the use of full or slight correction of their hypermetropia.

Two hundred and sixty-two of the patients had periodic strabismus, 210 of these cured. Thirty eyes straight but binocular vision not obtained by use of lenses alone. In 10 patients stereoscopic exercises were employed. Sixty patients were finally cured by occlusion and exercises with the diploscope and stereoscope. In two patients divergent strabismus resulted. In 20 patients the periodic strabismus became permanent, but in most of this group the parents were careless about the use of the lenses and exercises.

Schwenk reports a patient, aged 28 who from injury severed the attachment of the inferior rectus from the globe. When first seen the eye could not rotate below the horizontal plane and the patient was annoyed by the diplopia. Under general anesthesia Schwenk made a horizontal incision across the globe, dissecting well the conjunctiva below the attachments of the cicatrix and at the inner side of the globe. The cicatrix was then loosened from the eyeball, the cicatricial mass excised and the muscle with Tenon's capsule brought up and held in place by sutures. One end of the inner thread was passed under the tendon of the internal rectus and the other into the sclera back of the horizontal plane and tied. One end of the outer thread was passed under the tendon of the external rectus and the other end into the sclera and conjunctiva and tied. The patient had fairly good rotation downward and is free from diplopia.

HETEROPHORIA.—**Flack** outlines the visual requirements for *aviation*, stating that the selection of the flying officer is the work of the clinician and of the physiologist. In the records of the Aviation Candidates Medical Board, no individual with worse vision than 6/12, 6/18 was included. For military service, available evidence is in favor of normal vision in pilots, small defects only being in any way admissable, if prolonged, efficient, and distinguished service is to be rendered by the candidate. Also, good ocular muscle balance with good visual fusion is necessary if the subject is to learn to land his machine properly.

Experience has shown that, from one cause or another, ocular muscle defects may also appear after admission, either in candidates during training or in officers after considerable periods of service; these defects creating difficulty and even inability to estimate the distance the subject is above the ground, causing "flattening out" too soon or too late and consequent bad landings. The exact condition in cases of heterophoria can only be worked out by the ophthalmic surgeon.

Major Clements found that many of the defects shown by these tests were amenable to treatment by suitable eye exercises with Worth's amblyoscope and Wells' charts. From August, 1917, to July, 1918, he saw and treated 104 officers who would have been "turned down" for bad landings if they had not been sent to him for treatment.

Seventy-three of these cases were officially traced. Of these 55 subsequently proved successful, in flying, often on active service; 4 proved failures, primarily on account of the persistence of their inability to land a machine after treatment; 6 were found unsuitable for flying; 8 were found unfit by medical boards for various reasons, neurasthenia, heart trouble, apart from or in addition to their eye trouble.

Sheard advocates the taking of the binocular fixation fields as part of the tests in all cases showing a vertical imbalance of one or more degrees. The presence or absence of hyperphoria should not be based upon one test alone; there should always be a system of checks. The author then mentions the test with Maddox rod; screen and parallax method; the duction test; and by Graefe's dot and line test with the use of the double prism or the small electric lamp.

ETIOLOGY OF HETEROPHORIA.—**Andrews** writes on heterophoria from *ethmoid disease.* He believes the close priximity of some of the accessory cavities of the nose to the origin of the muscles controlling the direction of the eye movements, should lead one to consider what might be the effect of disease in these cavities upon the ocular muscles. The recti muscles have their origin around the optic foramen, the origin of the internal rectus being at the inner side and closest to the ethmoid cells. The bone between the attachment of the muscle and the ethmoid cells and sometimes the sphenoid sinus is no thicker than paper. It is difficult to conceive of the mucous membrane on the nasal side of this partition being inflamed without the attachment of the muscle on the other side of the partition being affected.

If the origin of the internal rectus should become inflamed, the eye at rest would take a position somewhat converging. When the patient attempted to bring the two eyes parallel for distant vision, there naturally would be a disinclination on the part of the internal rectus to relax sufficiently to allow the external rectus to draw the eye into a position parallel with the eye of the opposite side. This would cause discomfort in using the eyes for distant objects, and tests for muscular imbalance show marked esophoria. When convergence for close vision is attempted, the work thrown upon the lame internal rectus causes pain, the eyes tire easily and the muscle tests for close vision show marked exophoria, while there is a slight tendency in the normal eye toward exophoria in making the close test by means of the Maddox rod; patients with ethmoid disease frequently show an exophoria of 6 to 8 degrees. Esophoria in these patients as shown in distant tests varies from nothing up to 10 or 12 degrees.

It is not always possible to say upon first examination in a given case that the heterophoria is of nasal origin, but when a patient has asthenopia and the tests show esophoria for distance and exophoria for near, and nothing is done for the patient but to relieve conditions in his accessory sinuses and the asthenopia disappears and the muscular balance is restored, one naturally suspects that the nasal disease bears a more or less direct causative relation to the eye symptoms.

The author would call attention to the large number of cases that pass from one oculist to another without finding relief from the most careful refractive correction. He suggests that in many of these cases a thoro examination of the nose might show indications for treatment that would bring relief to the sufferers.

The relation of *intranasal pressure* to heterophoria is the subject of a paper by **Griscom**, who reports a case illustrating the condition. A man of 30 since childhood had suffered from headaches, ocular discomfort and inability to read for any length of time. The media and fundi in each eye were negative. With correction, there was no esophoria or exophoria at 20 feet, but there was a hyperphoria of variable degree. The futility of any attempt to correct it was shown by the fact that the patient had worn glasses for 15 years, with prisms that were changed every few months with consistently unsatisfactory results. During the search for the cause of the fluctuating heterophoria, it was discovered that a sharp septal spur was pressing on a swollen middle turbinate. The nasal condition was corrected. Two months later the writer found a hyperphoria of 4 prism diopters with no variation at all. This correction was incorporated in glasses and his relief from all muscular asthenopia was marked. The patient gained in weight, and could read at night or on the train with greatly increased comfort. In this case there was no ethmoid or sphenoid sinus involvement. The writer is well aware of the fact that the ethmoid or sphenoid sinuses may be the seat of trouble without any gross evidence of inflammatory involvement, but in this as well as one other case reported, there was every reason to believe that the predominating etiologic factor was the pressure between the septum and the middle turbinate, which reflexedly caused irritability of certain extraocular muscles.

Ingersoll believes the fields of endeavor of the ophthalmologist and rhinologist are coming closer together.

Disturbances of ocular muscle balance due to intranasal pathology, with the exception of the reflex cases and those which are caused by toxic absorption where the focus of the infection happens to be in the nose, are due to their close anatomic relationship. Cases of ocular muscle imbalance coming under the above may be divided into the inflammatory and the mechanical, altho in many instances there is an overlapping, and this division merely indicates the predominating etiologic factor.

By inflammatory is meant those cases caused by extension thru blood vessels or lymphatics, or by direct continuity, of primary intranasal inflammation, and where the effect is brought about by inflammatory irritations rather than by the pressure of a gross pathologic abnormality. It is probable that many of the external muscle involvements, hitherto referred to under the vague term of "rheumatic," are caused by direct irritation of the bodies of the muscles which lie close to the walls of the inflamed ethmoid cells.

There is considerable variety in the intranasal pathologic conditions which cause the displacement or loss of motility of the eyeball. Areas of periosteitis resulting from sinus inflammation may often reach considerable size, and in chronic cases cause a permanent protrusion within the orbit. Gummata, mucoceles and sarcomata are not infrequent occurrences within the nasal accessory sinuses, and their extension into the orbit is sure to result in lessened motility, both from actual pressure on the globe and by destruction or irritation of the actuating nerves and the muscle tissue itself. Necrosis of the sinus walls, with fistula formation into the orbit, followed by exudative processes and edema, will have the same effect and it is not always easy to determine whether or not the condition is primarily nasal or orbital.

SYMPTOMS OF HETEROPHORIA.—**Macklin** presents a group of heterophoria cases. These cases exhibit, besides the local eye manifestations, certain general symptoms. They often resemble definite gastric or nervous diseases, or they may be indefinite and variable in character, thus in either case leading to an erroneous diagnosis.

First is considered the points that should make a physician suspect the presence of heterophoria. Speaking generally, these cases may show purely stomach symptoms, purely nervous symptoms or both. The onset is usually mild, with slow progress. Sometimes a history of chronic indigestion running over a period of years will be given;

in others a similar history of nervous disturbances, lassitude, dizziness and headaches. These patients will often be wearing glasses.

The author has made a study of muscular anomalies of the eye, and after giving the statistics of cures he has made, states that a cure can be obtained in about 98 per cent of the cases. He then considers in detail the symptom complex of heterophoria. In conclusion the author states that there are many patients who really suffer, are highly nervous, often distinctly below par, and who are apt to be regarded as neurasthenics, since it is difficult to find the real cause for their ill health.

Some fear going out alone lest they fall or lose consciousness, others lose confidence in themselves or their friends. Others go about their daily routine without snap or enjoyment. A remarkable metamorphosis takes place when the real cause is discovered.

TREATMENT OF HETEROPHORIA.—**Satterlee** says that to his mind there is such a thing as quality and quantity of fusion. It has always been taken for granted, the greater the heterophoria, the stronger the stimulus necessary to produce fusion and thus bring about binocular single vision. Hence a low muscular error was not supposed to require much stimulation to bring about fusion, and could be safely ignored. This, in his experience, has not always resulted in complete comfort to the patient in an otherwise careful correction of the refraction.

This leads to the question of the possibility of testing the power of fusion. To a limited extent the duction tests do this, but these do not tell whether there is a strain in the fusion faculty or not. The prisms used in the duction tests, cause the retinal images to separate and fusion unites them, so the tests measures the utmost distance between retinal images that fusion can overcome. This is a measure of the quantity of fusion, but does not give us any idea of the quality.

To sum up, the whole thing is in a crude and elementary state. Dissociation to start with is unnatural and develops or masks conditions that do not ordinarily exist. The tests seem to vary in the findings to such an extent, one is often perplexed to determine what is really the true state and having found it to determine to one's satisfaction what to do. In a case of weakened interni, some get relief from bases in, some from bases out, some will not tolerate any prismatic correction.

Squint cases are usually refracted and the centering left to Providence. Sometimes a segment is added to relax the ciliary muscle in reading but that is all. With the wide frames in vogue, the centers are invariably 4 to 8 millimeters too wide, creating a prism base out over each eye. The sphere tends to relax the eye muscles to normal, but this is more than offset by the haphazard centering, making a prism base out which turns the eyes in. No wonder we often fail to get satisfactory results.

Banister points out what is to be expected of normal extraocular muscles. The near point of convergence is found much more important than the power of convergence measured by prisms. But the abduction power measured by prisms is reliable. Muscle imbalance beyond the limits that may be accepted for normal is to be treated by correction of errors of refraction, muscle training and advancement, or shortening of the weak muscle; supplemented in extreme cases by tenotomy.

James states that there are cases where the anomalies are due to faulty attachment of muscles. In such, operation is often justified and it may be the only alternative for relief. Where the trouble arises from inherent or acquired weakness of the muscles, improper development or paresis, then gymnastics are indicated; when from overuse, general systematic depletion by illness or following major operations, rest must be the remedy.

The "Kratometer" invented by Dr. Hazen, of Des Moines, gives the author the best results in muscle training with prisms, young persons respond more readily to treatments than do older persons. To get good results it requires an average of twenty treatments, one each day. It is easy to overdo muscle exercises, and they must be carefully supervised by the physician in charge of the case.

Dean discusses the use of prisms, bases in. He does not prescribe prisms, bases in, in all cases of insufficiency. In some cases of the higher degree included in his series, an operation has been refused. He finds exercises to be of some value but seldom permanent. He believes that the constancy of the strength of prisms taken in his patients after years proves that the defect is not one of innervation which would undergo more or less change but is an anatomic defect. He even corrects exophoria of 1/2 degree, and often gives a patient comfort in this way when correction of the refractive error alone has proved unsatisfactory. He believes cases which appear to increase the strength of their prism are those in which full correction was not given at the first test, due to muscular spasm which was not fully relaxed. He showed a table of similar data compiled from his cases of hyperphoria. He said that the method, tho not scientific, had given patients comfort after other methods in the hands of good men had failed.

Thorne finds heterophoria in emmetropic cases, the cause being excessive eyestrain. The treatment is eye rest, regulated exercises of the defective muscles, weak prisms or operation.

Maddox regards the treatment of heterophoria as simple if its nature is understood. The elementary principles are: (1) Discover the cause and remove it if possible. (2) Correct any error of refraction with perhaps, a little decentering of the lenses in the direction of relief. (3) For lateral deviations complicated by hyperphoria, correct vertical deviation first. (4) If, the above symptoms continue, train the weak reflex or the weak muscle. This is chiefly valuable in young people. (5) Operation. This is generally the last resort after we have helped Nature to do her best.

Polliot devised an instrument for exercising binocular vision, composed of an optical system, a combination stereoscope and pseudoscope with movable spirals as test objects.

INDICATIONS FOR OPERATIONS.—**Cabannes** operated upon two young girls with strabismus with different etiology. One had corneal opacity with slight astigmatism. The other had no lesion of the cornea, but she could not fix with her deviating eye. The first was operated upon by a tenotomy of the left internal rectus. Three days after the operation the deviation was the same as before the operation. Five days later advancement of the antagonist was performed. A simple tenotomy corrected strabismus of the other child and deviation did not return. He suggests intervention in two stages. In the first stage, simple tenotomy—wait a few days and if the result is not sufficient resection of the antagonist. If both operations are made at the same time, there is danger of over correction.

Pollock urges early operation for strabismus. In former times it was said one should wait until a child was 15 years old before operating for squint. When it became generally recognized that by this time the squinting eye was often hopelessly blind and practically useless, it was suggested that the operation should be performed at 7 years of age. The writer has found that this age is far too late in many cases. A seven year old child is often brought for treatment, who has had two or three pairs of glasses and is still squinting, while the squinting eye is nearly blind. Cases are presented to show the beneficial effect of early operation and training of the amblyopic eye. Each of the cases showed an improvement in the vision of the squinting eye, after operation, two of them improving without any occlusion of the good eye. If the operation is delayed, there is less likelihood of disappearance of the amblyopia, and it is not to be expected after the age of 15 or 20. One objection raised to early operation is, that if the squint is left alone, a certain number of cases come straight. In the writer's experience these cases are nearly always those which have become amblyopic in the squinting eye. In such cases, had operation been performed within a short period of the onset of the squint, the amblyopia could have been prevented.

Moretti sums up the arguments for tenotomy and for muscular advancement, and decides that each has its place in selected cases. In cases of convergent squint his procedure is:

1. If the squinting eye is amblyopic and cannot be corrected by glasses, there is no object in doing an advancement as no functional result can be expected. If the deviation is more than fifteen degrees, a complete tenotomy is done, and if this does not produce enough effect, a tenotomy of the other eye, complete or incomplete, according to the indications is done later. If the original squint is less than fifteen degrees, a partial tenotomy is done, usually on both eyes.
2. If one eye is capable of useful function, orthophoric methods, including muscle exercises and exclusion of the fixing eye, are given a thoro trial and operative procedure undertaken only when they have definitely failed. If a purely functional squint remains without organic contracture of the muscles, an advancement is done. If the squint is less than fifteen degrees, an advancement is usually sufficient. If over fifteen degrees, a later tenotomy of the internal rectus of the same eye is usually necessary and in many cases is followed by a tenotomy on the internal rectus of the other eye if any deviation is left. If, after advancement, there is considerable enophthalmos and still some squint remaining, an advancement may be done on the other eye to make the deformity symmetric.

The views advanced by **Banister** on the surgical treatment of comitant and paralytic strabismus are founded on experience extending thru many years. Comitant strabismus is limited to two forms, internal and external squint. In paralytic strabismus the deviation depends upon what muscle or muscles are paralyzed.

In a case of internal or convergent strabismus, complete tenotomy of the internal rectus muscle of the squinting eye is advised; if a manifest degree of squint still remains, advancement, or tendon shortening, of the external rectus of the same eye should be performed. The latter operation, combined with the use of correcting lenses, is advised for intermittent convergent strabismus. External strabismus may be treated by a tenotomy of the external rectus, combined with tendon shortening of the internus.

In paralytic squint, a positive pathologic state must be considered and therapeutic methods should be employed before proceeding to surgery. Operations are outlined for various paralytic squint conditions, and in conclusion it is advised that in paralysis of the superior oblique the inferior rectus of the sound eye should be tenotomized; in paralysis of the inferior oblique of one eye, the superior rectus of the other should be tenotomized. The purpose of both operations will be to create in the sound eye a deviation which will correspond to that induced by the paralysis affecting the other eye, resulting in relief from the diplopia.

Green from observations based on a careful study of 260 private cases concludes less than 25% of squinting eyes were improved by nonsurgical methods and only 18% were cured, with eyes parallel. Improved cases often resume their squint when glasses are not worn. None of the 18% of cured patients was eight years old, and most were under six.

To determine whether operation is indicated, measure the degree of deviation with the Schweigger hand perimeter. The parent is instructed in applying 1% atropin ointment into the conjunctival sac for five days, when cycloplegia should be complete, so that the deviation can be measured on the perimeter and the eyes refracted. This examination decides the necessity of operation. If the strabismus is due to an error of refraction or accommodation, the extrinsic muscles being normal. there will be a decrease in the amount of deviation. If the eye becomes straight the case is nonoperative and glasses correcting the entire refractive error are given, with exercises, atropin in the fixing eye, fusion training, etc., as indicated to promote binocular fixation. If the eyes are partially straightened under the atropin, the case belongs to the delayed group and the same treatment is instituted.

Bettremieux prefers to *operate on the directing eye* rather than the deviating eye. When the directing eye is interfered with, neither the motility nor aspect of the eye is changed; the desire for clear vision maintains it in position in all movements. Modification of convergence innervation shows itself in the deviating eye by improvement of the strabismus. Theoretically it is impossible to do better. If the deviating eye is interfered with, we do not know exactly what we are doing; the most we can say is that we place the muscles in a better position to receive nerve impulses and we modify their function to compensate for the defective innervation. He states that many authors suggest waiting until ten to eighteen years before operating, and this shows that operating on the muscles of young patients, when the deviating eye is selected, does not inspire confidence. Bettremieux believes that operations performed on the directing eye overcome this obstacle.

Sykes deals with the principles concerning the treatment of the usual strabismus cases. Complete tenotomies are never justified. If the tendon is thoroly exposed before sectioning, one should be reasonably sure of not severing the whole attachment. If a partial tenotomy is not sufficient, the weaker muscle should be shortened. Resection and tucking are preferable to the advancement operation, which is rarely justified.

VERTICAL STRABISMUS.—**Bielschowsky** states that the fundamental principles for the operative treatment of horizontal squint are also applicable in the treatment of vertical squint. There are no greater and no more technical difficulties involved in the latter than in the former. The many failures encountered as far as the ultimate results are concerned, are due to imperfect knowledge or insufficient investigation of the physiologic action of the individual vertical oculomotor muscles, with consequent wrong decision as to which muscle is to be operated on. The author, for example, has achieved his best and lasting results in paralysis of the trochlearis by operating on the inferior rectus of the healthy eye, and this in spite of the fact that such authorities as Stevens, Worth, Landolt and others condemn tenotomy of the rectus inferior for this purpose.

The reason for this is because these authors attempt to establish uniform operative rules for all cases. This is obviously impossible, because each individual case is a law unto itself and needs individual investigation as to the conditions at fault. In this manner the "overeffects," so much feared by the opponents of this method, can best be obviated. For similar reasons, it may, therefore, in some cases be necessary to shorten the superior rectus of the nonparetic eye in order to get proper fusion of the image in both eyes. Isolated palsies of the other vertical oculomotors very rarely present indications for operative intervention. The same holds true of inferior oblique paralyses. Should, however, operation be indicated here, tenotomy of the superior rectus of the nonparetic eye, as practiced by E. Fuchs and M. Sachs, has also, in the author's cases, accomplished most satisfactory results.

Kearney reports a case of paralysis of the inferior rectus, relieved by advancing the paralyzed muscle.

L. F.; aged twenty-seven, was first seen August 17th, 1920 and gave the following history: When nine years old she fell from the fifth story of a building and was taken unconscious to a hospital. On recovery all objects appeared double. To see them singly, she was obliged to hold her head down on the right side. This has continued for eighteen years. She complained of dull aching pains on the side of her head, in the neck muscles, and upper chest muscles on the right side. For the past year she had nose bleed daily from the right nares.

Vision—O.D. 20/20 unimproved by lenses. O.S. 20/40; a minus 2.00 diopter cylindrical lens, axis 165° gave 20/15.

With the head in normal erect position and looking straight ahead, a light at 20 feet distance was seen double, the false image appeared down and to the left of the bright one, indicating a paralysis of the inferior rectus muscle of the left eye. A prism of 22 diopters base upward in front of the right eye was required to place the two lights on line horizontally and in this position they were about 2 1/2 inches apart. The pupils were circular, equal and promptly responsive to light stimuli. Media clear and no changes in the fundus of either eye. August 23, 1920, the author's advancement operation was done upon the inferior rectus muscle of the left eye and the stitches removed ten days later.

The patient now carries her head in the natural position. She does not suffer from pain or nose bleed or double vision, and wears spectacles for her visual correction only.

TENOTOMY OF INFERIOR OBLIQUE.—**Parker** cites a case of his own of a boy of fourteen who complained of blurred distant vision and double sight, which was troublesome only when wearing glasses. After giving the results of an examination of the boy, the diagnosis is given, i. e., spasm of the right inferior oblique with partial loss of power in the left superior rectus. The author then gives the details of the operation which were as follows:

Tenotomy of the right inferior oblique at its origin. Convalescence was uneventful and when the patient left the hospital there was no diplopia and no hyperphoria or exophoria could be demonstrated. Three months after operation, he had 3 degrees of right hyperphoria, one degree of exophoria and no diplopia. He held his head erect and expressed a great sense of relief.

CONVERGENT STRABISMUS.—**Hoorens** made a statistical report of 200 cases of strabismus operated upon and followed up during several years. These patients were operated on by the following different methods: (1) Unilateral tenotomy. (2) Unilateral tenotomy combined with musculo-capsular advancement. (3) Double tenotomy. (4) Double muscular advancement (method of Landolt). (5) Tenotomy of the good eye. (6) Double capsulo-muscular advancement.

In strabismus of very slight degree, Hoorens practices tenotomy of the healthy eye, in young patients whose recti muscles function well, and tenotomy of the deviating eye in old patients with insufficiency of the externi. For strabismus of moderate degree (20° to 30°), simple tenotomy of the amblyopic eye or tenotomy combined with capsulo-muscular advancement, and for moderate strabismus with good visual acuity, double muscular advancement. In pronounced strabismus, with the deviating eye amblyopic, tenotomy is combined with musculo-capsular advancement, and in pronounced strabismus where the deviating eye has good vision, double muscular advancement. Finally, in very marked strabismus, tenotomy combined with capsulo-muscular advancement, and in alternating strabismus, double muscular advancement or double tenotomy.

Ballantyne was inclined to operate at an earlier age than formerly was thought desirable. Advancement alone sufficed in many cases; he had never seen permanent over correction result from advancement or muscle folding, therefore he would not hesitate to operate at any age. Worth's operation could be depended on to correct 20° or 25° of convergence. The muscle folding operation gave about half this effect. He rarely did tenotomy of the internal rectus, and he objected to combining tenotomy with advancement at one operation in a patient under 16 years.

TENDON LENGTHENING. — **Terrien** prefers advancement to tenotomy due to the danger of postoperative muscular insufficiency. However, tenotomy is indicated when the deviation is monocular as the result of amblyopia or opacities of the cornea and when the heterotropia is marked. He also advised tenotomy in older people with convergent strabismus and fibrosed internal recti. In paralytic convergent strabismus, advancement of the paralyzed muscle gives but poor results so he prefers tenotomy of the internal rectus. To avoid secondary insufficiency, partial tenotomies are suggested at the tendinous insertion. He believes this of value where an advancement has not given complete correction or where over correction is desired, but it is insufficient if the deviation is marked. He suggests tendon lengthening by his method in these cases.

He uses Hibbs' method of tendon lengthening applied to the eye. (1) Tendon stretched between 2 hooks. (2) Incision parallel to the insertion of the tendon at 2 mm. from the insertion and another 4, 5 or 6 mm. back of it, on the other side of the tendon, each one cutting 2/3 of the tendon.

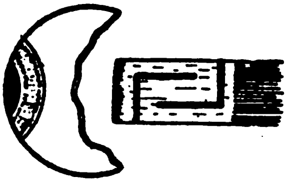

Fig. 11.—Method of incising tendon for Terrien's operation of tendon lengthening.

The first incisions are extended at right angles by incisions parallel to the border of the muscle, to within 2 mm. of the perpendicular incision. The tendon is elongated about three times the distance comprised between the two perpendicular incisions.

Advancement.—The following proceeding is recommended by **Alexander** as obtaining primary correction as accurately as can be judged of objectively, or subjectively by the patient looking at a distant candle with a red glass over his better eye.

After raising the conjunctiva up to the border of the cornea, a needle threaded with No. 3 silk is passed vertically thru the sclera 5 mm. from the cornea and 1.5 mm. below its horizontal diameter, to emerge a similar distance above this line, when it is removed from the thread. The forceps holding the tendon freed from the sclera is held by the assistant.

The thread is loosely crossed in a single knot over the tendon at the level considered likely to give the required advancement on the basis of 1 mm. to 2.5° of deviation, and as the knot is tightened the tendon is kept doubled back on the belly of the muscle by the assistant till the tendon is firmly strapped to the sclera. It is now easy, if correction has not been obtained, to loosen the knot, shift it farther forward or backward, as the case may be, and proceed as before in another attempt, until success is obtained.

Then the knot is completed as a reef knot, and the tendon in front of it cut off close to it, the suture being allowed to remain in till it works loose.

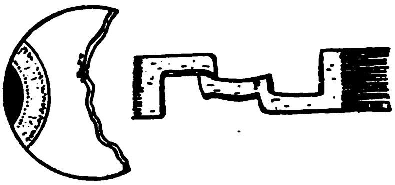

Fig. 12.—Lengthening of tendon secured by pulling out after the incisions shown in Fig. 11.

Terrien published an article on advancement of ocular muscles in the treatment of strabismus (See v. 16, p. 50) in which he advocated the employment of a complementary suture intended to counteract the loosening of the newly attached muscle from tearing of its cut end by the stitches. **Landolt** now writes that, in his experience, this second suture is unnecessary, and that he guards against a diminution of the effect of the advancement by an initial overcorrection of the squint. He lays emphasis upon the expediency of this overcorrection, and also upon the advisability of keeping both eyes bandaged for a week after the operation.

Van Lint outlines a muscular advancement with reinforcing suture at its insertion. A successful advancement operation must fulfill two points: it must involve no danger to the eyeball and must insure firm union at the new insertion. The first point is assured by making use of the tendinous insertion close to the globe instead of penetrating the sclerotic, and the second is fulfilled by making use of two different sets of sutures, one uniting the muscle belly to its old insertion, the other its cut end to the conjunctiva.

From the examination of the results of operations in dogs, it appears to **Duverger** that the advancement of the muscle is effective from the anatomic viewpoint, as the fibers of the tendon reach the limbus. There is, however, no advancement of the muscular insertion from the physiologic viewpoint, as the tendon adheres to the sclerotic up to the point where it was inserted before the operation. Then, from the physiologic viewpoint, the advancement in the dog is represented by a shortening of the muscle.

Tucking.—The chief objection to the Briggs operation, according to **McLean,** seems to be that it is difficult to remove the silver link, used to hold the tendon while union is taking place in the shortened muscle. The Briggs operation consists in exposing the muscle that is to be shortened, drawing the tendon thru a silver link and then squeezing the link together so that it holds the loop of tendon firmly in its grasp; and this metallic suture is not removed until the crushed tendon has thrown out adhesive bands and become securely cemented in its shortened relation. The conjunctiva closes over the operative field and no sutures are required. After ten to fourteen days the link is removed. Sometimes difficulty is encountered here, and the author suggests a means of avoiding trouble at this juncture. He modifies the operation by attaching two short but heavy silk threads to the ends of the link before it is put in place. These threads are left about 10 mm. long and their purpose is to facilitate locating the link when the time comes for its removal. For the purpose of removal he employs a pair of forceps to pick up the thread, and link, and a pair of watchmaker's cutting pliers, the sidecutting type, to cut each end of the link in turn; withdrawal of the thread then brings away the separated halves of the link. Very satisfactory results from the operation are reported.

Looping.—The special equipment for the operation of looping described by **Schwartz,** consists of 2 double armed sutures, about 12 in. long, threaded through a gold plate 2 by 7 mm., in which 4 holes are drilled 0.75 mm. apart and each 1 mm. in diameter; 2 of these plates are required in the technic, the first thru which the sutures are passed in the manner to be described, and the other over which the same sutures are to be tied upon completion of the operation. The suture is threaded thru the first 2 holes of the plate with a loop on one side and the needles and remaining silk protruding on the other. The second suture is passed thru the other 2 holes in like manner. A complete tenotomy is formed on the side of the squint and that conjunctival wound closed by suture.

Then, on the opposite side of the globe, where the muscle is to be shortened, an incision is made thru the conjunctiva and Tenon's capsule at a point over the insertion of the rectus. The muscle is brought up by a tenotomy hook in the usual way, and after it is exposed another hook is introduced beneath it, so that it may be freed from underlying and adjacent tissues for about 10 mm. of its length, by gently pulling on either hook in opposite directions. The muscle is held away from the globe by the hooks and its under surface roughened by the aid of a scalpel, so that when finally approximated these surfaces will adhere. The tenotomy hooks still holding the muscle away from the globe, the muscle is split down its middle in the direction of its fibers for a distance corresponding approximately to an amount slightly in excess of deviation of the strabismus in millimeters, as determined by previous measurements.

The needles of the previously described sutures are introduced thru the conjunctiva next to the posterior border of the incision. The split portions of the muscle are now held apart by 2 pieces of suture silk manipulated by an assistant. Tension upon these separates the two parts of the muscles in such a way as to have the pull directly at the center of each portion of muscle, so that when the sutures are introduced in the next step, there will be an equal amount of muscle tissue on either side of the loop. There have now been formed, above and below, 2 angles of rectus tissue, the degree of angle depending upon the pull exerted upon the silk in the apex of either angle. The outermost needle above or below, is now passed thru the muscle near the apex of the angle, and then thru the muscle tissue of the other side at a point opposite where it pierced originally. The suture next to this one is put thru a similar procedure, with the exception that it is introduced thru the muscle at a point near the beginning of the slit and pierces the tendon at its insertion. The remaining 2 sutures are disposed of in the same way, the outer one first, thru the other loop of muscle. The next step is to pass the needles in their respective order thru the conjunctiva from its scleral surface to the outside, at the anterior border of the incision, and then thread them thru the second gold plate. When the sutures are pulled taut, the outer one on either side is tied with the one immediately next to it; this brings the plates one next to the other, and they exert an action similar to a clamp on the looped muscle. Both eyes are bandaged for eight days and the sutures not removed until the twelfth day.

Moretti described his procedure by which he avoids the necessity of cutting a muscle, which he calls *myotenorrhaphy*.

A conjunctival incision is made, the tendon isolated by two hooks, and a long incision is made in its middle, being longer in proportion as the deformity is marked. One double armed suture passes thru the belly, the needles being brought out thru the conjunctiva above and below the globe. When these are tied, the muscle belly is drawn close to the tendinous attachment, the strands being arranged in a flattened T. Two supplementary sutures are placed thru the conjunctiva and the scleral attachment, while the assistant holds the eye out. Both eyes are bandaged for five days, after which the sutures are removed.

Resection.—**Fromaget** suggests a slight modification of the operation described by Duverger and Metley (v. 17, p. 57). The operation is a resection, and they object to the original method of passing the suture, for the silk was interposed between the legs of the wound as in the Reese operation. They pass a double armed suture thru the conjunctiva over the tendon insertion, then thru the tendon insertion, then from behind forward thru the muscle and conjunctiva.

In his endeavors to secure a proper advancement procedure, **Posey** has searched thru all the literature and has practised a variety of procedures. For the past few years, however, in high degrees of squint, abandoning all other procedures, he has practised solely the single stitch operation as described by Jackson in "A System of Ophthalmic Operations." The one objection he has found to this method is the amount of tension placed upon the scleral anchorage in some cases of very marked deviations, in consequence of which the stitch may cut thru the tissues on the third or fourth day after operation. This has been overcome by the employment of two sutures instead of one, placing them parallel with one another, the superior including the upper half of the tendon, the inferior the lower half. The virtues of this operation consist in its simplicity. The procedure is nothing more surgically than the conjunctival incision, the resection of the muscle and its supplying tissues, and closing of the wounds by two mattress sutures. Looping or knotting the suture in the muscle, which tends to impede the vascular supply of the tissues and produces unfavorable reaction, and also renders the removal of the stitches difficult, should be avoided. Simultaneous inclusion of all the tissues in the suture prevents the pulling out of its muscular anchorage, which sometimes happens when the muscle alone is secured. Slight traumatism is done to the parts, and there is absence of puckering and rucking of the tissues.

Wilkinson's examinations are conducted with the perimeter and the Priestley-Smith tape with Dr. Holtzer's modification. He makes it a rule to operate, at any age; when the amount of deviation makes it impossible to secure binocular vision and does not decrease after six months or a year under the use of atropin, glasses, pads, and exercises. A careful record is kept of the amount of squint; if it increases under the use of atropin, glasses do not, as a rule, bring relief. Tenotomy is not necessary and is decidedly harmful. To make a weak muscle stronger, rather than to make a strong muscle weaker, is his aim. His operation consists of two steps, one being new, namely: anchoring, in the angle of the eye; a brace consisting of a piece of lead plate 1/2 millimeter thick, 2/5 of an oval in shape, the flat side measuring about 14 mm.; the diameter being 10 to 12 mm.; a small hole in each corner of the brace and two holes near the arc of the circle. A no. 14 twisted silk suture is passed underneath the tendon of the rectus muscle opposite the muscle to be advanced, and is threaded thru the two holes at the corner of the plate. A second suture no. 8 or 10 thread is passed into the tendon and is threaded thru the two holes in the arc of the plate. After the advancement or resection has been completed the lead plate is tied down snugly to the eyeball, the lids closed over the same, and it is left in place till the eighth day, when plate and all exposed stitches are removed. The second step is in many respects like Reese's operation, yet different in its essentials, and the stitch is much like Lancaster's tho used differently. The pull of the strong muscle is measured with a special scale; the exact amount of tucking done is measured with calipers.

Ellett reported two cases of convergent strabismus in which the Reese operation was performed. Sloughing occurred in one case but the cosmetic result was good in both.

Kleefeld speaks briefly of the anatomy of the insertions, and outlines the various types of muscular sutures which he believes do not hold as well as his crown suture, which is explained by figures in the text. The suture is used after a resection and the suture material is catgut, which is buried. Experiments are outlined to show that this is the strongest of several methods.

Andrade thinks atropin is of value, as well as orthoptic treatment, in curing periodic strabismus, but of little value in the treatment of permanent strabismus. Much time is lost in treating patients medically who should be cured surgically.

Various operative measures are considered; he prefers a tenotomy and advancement at the same time, not attempting to procure more than 12° of correction by tenotomy of an external rectus or 15° by tenotomy of an internal rectus. He avoids cutting the lateral attachments, and prefers the advancement of de Wecker.

Bernabe reports thirty-two cases with more than 20 degrees of deviation operated upon by the O'Connor method. The results were excellent and the author advises the use of this method. **Fenollosa** prefers Blanco's operation, which is a tenotomy of the internal rectus and advancement of the external rectus by folding the tendon on itself.

Zamora writes that squint is very common in Spain. The author gives numerous illustrations of patients before and after operation, with a short resumé of the clinic history and the type of operation performed in each case. The subject of squint is well covered in this paper.

IMMOBILIZATION OF EYES.—**Axenfeld** writes on cosmetic immobilization of the eye. He describes an operation probably never performed extensively.

In 1904 a girl of 8 years of age was run over by a heavy freight truck, one wheel passing over her head; no injuries beyond skin abrasions; nose bleed; coma during several days; and, on regaining consciousness, headache, vertigo, diplegia of the extremities; these symptoms were slowly compensated except the ocular disturbances of marked left ocular paralysis and left pronounced loss of vision.

On admission to clinic four weeks later, ocular findings were: left eye complete paralysis of oculomotor and its branches; rigid pupil; paralysis of accommodation; eyeball intact in divergence; abducens and trochlear normal; complete flaccid ptosis; free visual field, right eye, extremely wide open; levator very contracted; eyeball strongly divergent with extreme changeable deviations in various directions; very narrow pupil; marked decrease in visual acuity; very restricted visual field, disc growing markedly paler during next few weeks.

Diagnosis: Severe basal fracture producing temporary paralysis of the limbs; fracture of the right optic canal with incomplete atrophy of the optic nerve; complete permanent paralysis of the oculomotor on the sound side with secondary contraction of the abducens and development of the pseudo-Graefe symptom.

In 1907, after spontaneous involution could no longer be expected, operation was performed; the paralyzed left internal rectus was brought forward and the abducens was set back; this operation had to be repeated twice later, and in 1920 the eyeball was simultaneously abducted and fixed by a temporal suture fastened to the nose and grasping the sclera, thus fixing the paralyzed eyeball about in the middle.

From 1910 to 1921 the right eye was operated; its muscles were normal, but the ball kept up extreme, variable, and very disfiguring movements; tenotomy of the four recti muscles was performed at four different times; secondary strabismus was slightly relieved; disfigurement still continued; tenotomy of the four recti muscles repeated in 1920; four sessions at intervals of one month: at every tenotomy a silk thread was drawn thru the scleral stump of the optic nerve and the eyeball fixed for several days in the extreme opposite position; this prevented absolute immobility of the recti but set the tendinous insertion of the recti back behind the scleral equator; the result was still unsatisfactory because of the continuously rotating two obliques; at the next operation myotomy of the inferior right oblique was performed according at Landolt's technic followed by extirpation of the right trochlea; this cut out both obliques so that the eyeball made but small horizontal movements, only produced from the set back recti muscles. The disfiguring lagophthalmos was corrected by tenotomy of the superior palpebral muscle; with local anesthesia with novocain-suprarenin; horizontal incision 3 mm. above the tarsus, exposing the tarsus edge and the tendon of the levator, carefully cutting this tendon without injuring the conjunctiva; no suture of tendon or skin; ointment dressing. In the next few days there were complete ptosis and slight edema of the upper lid; a week later both lids could be slightly lifted; during the next few weeks the lid was gradually lifted; the right palpebral fissure is slightly wider than the left; the right normal pupil is treated with daily instillations of 0.01 to 10.0 scopolamin to make it as wide as the paralyzed left pupil.

This operation proved that muscular action may be permanently decreased, tho not entirely eliminated, by complete tenotomy of the palpebral levator without injuring the conjunctiva, similar to rectal tenotomy on the eyeball.

According to Axenfeld tenotomy of the levator might be indicated in certain cases of Basedow's disease, as well as in unilateral lagophthalmos associated with Bell's symptom. Myotomy of the inferior oblique muscle might be indicated in paresis of the superior rectus muscle of the opposite side.

TRANSPLANTATION. — **Aranquez** does not think very highly of any of the operations for blepharoptosis, so he has devised one of his own, which he thinks is simpler and more effective.

The first part of his operation is identical with that of Motais. The differences between the two operations are:

Motais.	Aranquez.
1. Cuts and sutures part of the superior rectus to the eyelid.	1. Sections the elevator muscle and sutures it to the rectus superior. Simpler process.
2. The useful rectus muscle remains intact.	2. The useless elevator muscle is affected.
3. Muscular tissue sutured to fibrous tissue.	3. Joining of muscular tissue and muscular tissue. Better results assured because tissues are alike.
4. May cause keratitis and leukomas because of friction on the cornea.	4. Suture made higher. No such danger.

Peter presented a case of paresis of the external rectus in which he practised tendon transplantation by the O'Connor method. The patient was a woman, aged fifty-two years, who developed a convergent squint in late childhood. The left eye was turned in 30 degrees and could not be rotated temporalward more than to the center. Vision was much reduced by an old choroiditis.

Recovery was uneventful and the patient now has external rotation of 50 degrees and internal rotation of 40 degrees.

With a view to the improving of the technic, the author suggests that the external rectus should be advanced and attached to the stump of the tendon. The overlapping tendon should then be split in half, turned up and down toward the recti transplants and attached. In this change the nutrition of the tendon will probably be better preserved, and tendon will be attached to tendon with less chance of the stitches cutting thru. The external rectus tendon is very short, about 4 mm. in length, and the sections by the O'Connor method must include too much of the muscle, with more or less danger of the stitches cutting thru the delicate muscle strands, which are turned forward. Complete or partial tenotomy of the internal rectus must necessarily depend upon the degree of the temporalward rotation.

Posey reports a case of congenital hypertropia in a young man with marked facial asymmetry, the left side of the face being underdeveloped. With the left eye fixed in the horizontal plane, the right eye deviated strongly upward. Downward and outward motion in the right eye was abolished but the eye could be moved downward and inward to a certain extent by the superior oblique. All other movements of both eyes normal. On account of the absence of action of the inferior rectus, transplantation of muscles fibers from the internal and external recti upon the inferior rectus was decided upon. A curvilinear incision parallel to the corneal limbus was made laying bare the insertions of these three muscles. The inferior rectus was found to be absent except for a very rudimentary portion of muscle fibers found at the site of the usual insertion of this muscle into the globe.

The lower halves of the externus and internus were sewed into position thru this stump. A free tenotomy of the superior rectus was done. Care was taken to bring the capsule of Tenon forward below as much as possible by double single stitch sutures. Healing was prompt. At the end of two weeks the eyes were on the same horizontal plane, left hyperphoria of ten degrees, esophoria of twenty degrees at five meters (no measurement could be made prior to operation on account of the high degree of the deviations).

The technic of **O'Connor's** method of transplanting ocular muscles was described in the Transactions of the Section on Ophthalmology of the A.M.A. for 1916, page 241, and in this paper he discusses the conditions for which the operation is to be employed, and gives the histories of a series of cases treated. There were 7 cases of abducens paralysis, 4 complete and 3 incomplete. Results: In 1 incomplete there was entire failure to change the condition, and in 1 complete case no outward rotation was obtained, but only a cosmetic result. In all the others satisfactory results as regards position and rotation were secured. In 1 case of superior rectus palsy, the result was excellent. In 6 cases of ptosis, the Motais operation was successful in uncovering the pupil even in extreme upward rotation.

Such good results make it worth while to try transplantation, as these cases were otherwise hopeless. Operation is advocated for performance before contracture starts in the opponent of the affected muscle. Usually a paralysis shows early improvement and a fairly rapid progress toward its final position. If it is complete at the end of three months, in spite of proper treatment, the prospect of cure is too slight to warrant further delay. In cases of incomplete paralysis, operation should be delayed until it is certain that progress toward cure has stopped.

Sweet presented a girl, 17 years of age, upon whom a portion of the superior and inferior recti muscles had been transplanted for the relief of a complete palsy of the external rectus muscle which had existed from childhood. The results were excellent.

PARALYSIS.—**Abelsdorff** considers the etiology, symptoms and treatment of ocular muscle paralysis. **Cords'** observations, with reports of clinical histories, show that the amyostatic complex of symptoms of Strumpell also occurs in the eyelids and ocular muscles, under the picture of myostatic rigidity. It is characterized by a striking lack of mobility and irresponsiveness of the ocular muscles to voluntary reflex and psychoreflex impulses. Also cataleptic phenomena occur. The capability of all motions is preserved. This disorder is neither cortical nor in the old sense supranuclear, but is to be localized between the cortex and centers of fixation. It is strictly distinguished from paralysis of fixation, apraxia of ocular muscles and pseudoophthalmoplegia of Wernicke.

Collier referred to his cases of paralysis as due to orbital periostitis or fibrositis. They had a characteristic clinical aspect in the majority of the cases, and in his experience had always recovered. The characteristic symptoms were: 1. The onset with orbital pain of neuralgic character, which might be slight or even absent in those cases in which the sixth nerve only was involved, but which might be terribly severe and lasting when the first and second divisions of the fifth nerve were involved. 2. Proptosis, slight in degree but always detectable. 3. Tenderness on pressure upon the globe of the eye. 4. Oculomotor paralysis. The sixth nerve seemed to be commonly the first to be affected, and the pathologic process might not extend beyond this nerve; but the usual sequence was the involvement of sixth nerve, third nerve, first division of the fifth, fourth nerve and second division of the fifth, in that order.

He had not been able to trace any septic process, in nose or sinuses or teeth in connection with this malady, but in one case secondary growth from a concealed epithelioma of the nasopharynx had given an almost identical clinical picture for a time. Exposure to cold upon one side of the face had been the indubitable cause in a few of the cases. The less severe cases had recovered in about six weeks, the severe cases in from three to five months, and every case had recovered completely except for some tendency to neuralgia in the fifth distribution. The treatment adopted had been, (1) inunctions of mercury, (2) internal administration of iodides and salicylates, (3) warmth and counterirritation to the temple, (4) adequate measures for relief of the severe pain. The analogy with peripheral facial paralysis was striking; the only known causal factor, exposure to cold, the onset with pain and with swelling and tenderness in the region of the styloid process in facial palsy, and the almost invariable recovery with the same treatment in the two conditions.

Wilson discussed the question of a possible unilateral *cranial polyneuritis,* a subject of considerable clinical interest, tho still largely speculative. During last year he had seen, at King's College Hospital, two cases, one involving the fifth, sixth, and seventh, the other and sixth and seventh, in both cases on one side only. The second of these cases was that of a girl who certainly had rheumatic "diathesis." There was a history of exposure to cold and she developed the familiar Bell's palsy, apparently coupled with slight but definite sixth nerve paresis. He could not prove the nature of the case pathologically, because it cleared up under antirheumatic remedies; nevertheless, he suggested that, in the absence of any other etiologic factor, one was justified in thinking it might be transient polyneuritis unilateralis. The other case was that of a slightly older girl, in whom the fifth, sixth and seventh were involved, and he had held a similar view of her case. On examining her at the end of the sixth month, however, he found the abdominal reflex on the opposite side was absent, and he suggested that in this case there might have been a small plaque of disseminated sclerosis. He only quoted it as a contrast to the others, in order to show how difficult it was to determine what was the etiologic factor in these cases. Unilateral cranial polyneuritis ought to be regarded as a clinical possibility.

ABDUCENS PARALYSIS. — **Brazeau** reports a case of abducens paralysis in a syphilitic which had to be considered medicolegally. **Caprario** diagnosed paralysis of the right external rectus in a child of seven, after fever and headache had lasted a day. The etiology was not determined.

Harvier has seen a myasthenic syndrome following poisoning with war gas. Several days after inhalation of war gas, which was not accompanied by any acute signs of poisoning, there appeared in a young soldier a general weakness and certain other symptoms, which disappeared spontaneously in a few days. They soon returned, with dizziness, tinnitus, left ptosis, sensory aphasia, visual disturbances and right hemianopsia. The latter soon disappeared. Examination three years later, showed general weakness, paresis of certain muscles, bilateral ptosis, with continual blinking, paresthesia of conjunctiva, epiphora, especially left, right abducens paralysis with diplopia which increased with fatigue, and restriction of all eye movements.

Hassin saw a colored soldier, aged twenty-four, admitted August 23rd, 1919, to the Cook County Hospital, Neurological Service. His head had been injured between two railroad cars, June 9th, 1919, and he was unconscious for the following three weeks. The ocular symptoms present were bilateral inability to close the eyes, complete paralysis of the left abducens, and loss of corneal and conjunctival reflexes. Nystagmus was not present.

Nicolich reports a case of injury of the sixth pair and ophthalmic ganglion thru the spheno-maxillary fissure from alcohol injection of trigeminus. This was a case in which paralysis of the external rectus with neuroparalytic keratitis resulted from alcoholization of the superior maxillary nerve. The treatment was given to cure neuralgia. After the third injection double vision occurred, with retroocular pain and a shrivelling of the corresponding cheek.

Conclusions: 1. It is probable and even easy to see that in treating with injections of alcohol a neuralgia of the trigeminus in its second branch, the injecting needle penetrated the orbit thru the spheno-maxillary fissure. 2. This caused a numbness of the external rectus muscle, and a neuroparalytic keratitis, by injury of the ophthalmic ganglion or its afferent branches. 3. Lesion of the ganglion brings on: iridoplegia by lesions of the motor neuron, corneal anesthesia by lesion of the sensitive nerve, and hypotonia by lesion of the sympathetic fibers. 4. The neuroparalytic keratitis is further produced by the alterations of the vital phenomena of the corneal cells, a consequence of the functional abolition of the trigeminus by infection of the corneo-conjunctival cavity. 5. Tear secretions were abolished both in their reflex and psychic action.

Fejer has had two cases of paralysis of the ocular muscles following injections of alcohol in trigeminal neuralgia. Both cases occurred in his own practice; in one the abducens was paralyzed and in the other the oculomotor nerve.

Case 1. Abducens paralysis: Woman, 50 years of age, complained of diplopia one week after an injection of alcohol in the region of the right malar bone, for trigeminal neuralgia. Improvement and loss of diplopia after use of sajoidin internally.

Case 2. Woman of 32 years, received injection of alcohol in region of left supraorbital notch for supraorbital neuralgia. Left eyelids swollen for a month. After two months, patient could scarcely raise the left eyelid, accommodation was weakened, the iris was dilated and did not respond to light. No improvement after a year. Alcoholic injection in the region of the eyeball is dangerous as neuroparalytic keratitis and optic atrophy has been described in the literature. Our cases for this injection should be carefully selected and our technic perfect.

Staehli observed ocular palsy as initial symptom of malignant tumor of nasopharynx. Case No. 1. Woman 62 years. Left abducens paralysis at first considered rheumatic as Wassermann was negative. Diagnosis of carcinoma of left nasal sinuses was made too late for operation. Case II. Man aged 49 years. Noted headache, diplopia and drooping of right upper lid, July, 1919. November, 1919, ptosis right upper lid, right ophthalmoplegia externa, complete except for slight movement of eye downward. Right iris sluggish to light and convergence. Left eye normal. Diagnosis made of inoperable sarcoma of the right nasal accessory sinuses.

Woodruff reported the case of a man, 63 years old, who was seeking relief from a marked paralytic convergent squint in both eyes, and gave a history of having fallen from a street car seven and a half years before, striking on his left outer and upper orbital wall. The essayist considered the case interesting because it was rare to have bilateral paralysis of the abducens, unilateral paralysis of the muscle being the most common of ocular palsies. Secondly, while it is a case of tabes with positive luetic findings, there was a definite onset within a few hours after a serious head injury. Also, because a good result was obtained by tendon transplantation of the outer halves of the superior and inferior recti muscles, which could probably not be obtained in any other way. The literature of similar cases of bilateral abducens paralysis following traumatism was reviewed.

Boehmig examined a soldier of nineteen years. After a slight attack of influenza, the patient suffered from right abducens paralysis. Two days after the end of the fever, the patient complained of diplopia and dizziness which disappeared ten hours later. Next day upon awaking the diplopia had returned. Wassermann negative. For four weeks the patient was under observation but showed no signs of returned diplopia. This case differs from most reported in that it recovered so quickly and suddenly.

Meyerhof has studied influenzal paralysis of the abducens nerve. The author concludes that the paralysis of certain muscles of the eyes during or soon after an attack of influenza is due, as in diphtheria, to the action of the toxins of the specific infection on the nerves of these muscles.

Vilaplana reported a case of abducens paralysis in encephalitis lethargica. On examination, the pupils were found normal. Keeping his head directly frontwards, and moving his eyes to the left, it was seen that the left eye could not follow the right eye in oblique vision toward the left side, losing the parallelism of the ocular globes. Therefore, there was a paralysis of the external rectus of the left eye and consequent diplopia when looking obliquely to the left.

Roy saw a patient with paralysis of the external rectus in the right eye following *mastoiditis* in the left ear. The author quotes the reports of eight other cases and also sums up a discussion of A. Paullier, in which Paullier points out that where lumbar puncture has been performed it has always shown increased pressure of the cerebrospinal fluid. He believes that paralysis of the abducens nerve on the side opposite the diseased ear is due to the increased pressure of the cerebrospinal fluid, acting upon a nerve which for some cause or other shows diminished resistance.

In treatment, he believes no further operation is necessary than to insure proper drainage of the diseased mastoid. Lumbar puncture is indicated, however, until the cerebrospinal hypertension is reduced.

Curschmann reports two cases of *myasthenia* in which diagnosis was difficult. Both cases occured in young girls of the chlorotic type without menstrual disorders. Both showed enlarged thyroid glands, but without Basedow's symptoms. In both cases there were no symptoms of disordered bloodglands. There was no polynuclear leucocytosis in either case. Case 1 showed normal leucocyte count. Case 2, leucopenia with relative lymphocytosis.

The nervous symptoms began in each case with uni- or bilateral ptosis, which in Case 1 was soon followed by diplopia and paralysis of other ocular muscles, which were not affected in Case 2. In Case 2, the walk became affected simultaneously with the ptosis. In both cases, the facial, speech, and throat muscles were affected with those of the eye. In both cases permanent paralysis ensued. Both cases showed the typical myasthenic reaction.

Komoto reports paralysis of the internal and external muscles as a complication of lethargic encephalitis.

Mollison describes two cases of paralysis of the eye muscles in connection with mastoiditis. In both cases the paralysis of the eye muscles came on in the course of mastoiditis; in the first case, after operation for acute symptoms arising in the course of chronic suppuration; in the second, in the course of simple acute mastoiditis.

Kan saw a fourteen year old boy, October 2, 1919, pain in right ear; October 9, right ocular paralysis, right drum membrane light red, dry scales in external meatus, slight decrease in hearing ability, no labyrinth phenomenon; on following day drum membrane was red and swollen, incision made, ear ran, paralysis improved, four days later ear was dry and drum membrane normal; no paralysis; no decrease in hearing. Gradenigo's syndrome is probably not the cause of the ocular paralysis in this case of quick recovery, but Kan shares Dorello's view that here the quick recovery from paralysis and the improvement in otitis media may be due to the disappearance of the inflammatory edema caused by the collection of venous fluid.

Marin Amat has seen paralysis of the sixth pair with neuralgia of the trigeminus, during suppurative otitis media. This is a case of a woman operated upon for suppurative otitis media, who then presented the syndrome of Gradenigo. The case is typical.

ETIOLOGY OF PARALYSIS.—**Harman** gave detailed notes of twenty-seven cases of ocular muscle paralysis classified according to presumed primary cause.

The cases fell into ten groups according to the known primary cause of palsy. Injuries, syphilis, and muscular disease or degeneration accounted for twenty-one out of the twenty-seven. Males were affected in seventeen cases as against ten in females. The left eye suffered in sixteen cases as against the right ten times. In single muscle paresis of the recti muscles, the superior was paralyzed four times, the inferior not at all, the external eight; and internal three times; of the obliques a superior was paralyzed three times, and inferior six times.

(1) *Injury,* due to falls, headed the list of cases with seven, or 24 percent; five were males. In five it was certain the injury played the primary part in the production of the paresis; in two there was a possibility that a "stroke" caused the faint or fall, and that the paresis might have been due to the effect of a cerebral lesion, but the balance of evidence supported the conclusion that the fall was accidental and the subsequent paresis was traumatic.

The diplopia was always persistent and unrelieved when complete, save in one case in which the vision of the eye was lost by steady progressive optic atrophy on the side of the injury. In another, in which the paresis was partial, the hyperphoria could be sufficiently corrected by a prism to give comfort.

(2) *Exposure*—Two cases serve as a bone of contention between the neurologist and the ophthalmic surgeon. So far as Harman could judge by views expressed in earlier discussions of this nature (e.g., at the London meeting of the British Medical Association), neurologists did not agree that exposure to wet and cold could be directly and solely re-

sponsible for an ocular palsy, but believed that it was only an initial symptom of some serious nerve disorder. In both of the two cases cited the association of chill with the paresis had been most definite, and it was noteworthy that there was no such association in any other of these cases. The peripheral nature of the lesion in Case 7 had been demonstrated by the appearance of the conjunctiva and local tenderness.

Both cases had recovered with remarkable speed, with no more treatment than blisters to the temple, fomentations, faradism, and massage.

(3) *Syphilis*—All five cases were in males. Relief was speedily obtained by appropriate general treatment given intensively and for a considerable period. There had been no further symptoms in these cases.

(4) *Migrain*—In these two cases the diagnosis had been difficult and had been arrived at by a process of exclusion. The age of the patients, 60 and 63, was against the diagnosis, but the character of the attacks and absence of other symptoms suggested some such vascular disturbance as migrain as the likely cause.

(5) *Vascular Disease*—The two cases, both in women, were of interest. In one postpartum epilepsy with albuminuria, and in the other diabetes was the assigned causes. In both, the diseases were of long standing, and in both the paresis was recovered from speedily and without recurrence, altho in both the primary causes continued, in the diabetic case with serious threat of cataract.

(6) *Senile Degeneration*—These three cases might have been added to the former group except that the ages of the patients sent them apart. In none of the cases had there been any indication of stroke or other serious cerebral disturbance, but probably each was due to some small hemorrhage. One only recovered from the diplopia and lived four years without further trouble.

(7) The remaining cases numbered six —(1) one of *myasthenia gravis* of seven years' duration, with ptosis and vertical diplopia. (2) one of *encephalitis* lethargica with relief of downward diplopia in nine months. (3) One of slowly growing *brain tumor;* during eight years there was a gradual increasing involvement of third and fifth nerves until death ensued. (4) three cases involving (a) left inferior rectus, (b) left external rectus, (c) left superior rectus. In each of these no cause could be assigned for the paresis.

Omitting the six cases of injury, the majority of the remaining cases supported the contention of the neurologist that paresis of an oculomotor muscle was a sign of serious general disease, but there was no evidence in the cases cited that life was shortened thereby.

In **Holmes'** practice at Moorfields Eye Hospital he had seen many cases of ocular palsy, and he was always conscious of difficulty in deciding what any case was likely to be due to. Only by careful weighing of signs of associated disease could a presumptive diagnosis be arrived at. In a considerable proportion of the cases of Graves' disease with ocular palsy, there was little proptosis, tho he admitted that in some the muscular weakness was due to mechanical conditions.

Wilbrand and **Saenger** stated that the ocular palsies in Graves' disease were usually due to nuclear degenerations. With regard to socalled rheumatic or toxic neuritis of oculomotor nerves, Holmes had seen a number of these cases and there was frequent involvement of the external rectus and of the muscles innervated by the third nerve, associated with pain in the forehead on the same side; sometimes there was considerable anesthesia. In some of the cases of the kind he had encountered, there was a septic focus in the vicinity. It was not yet known what a rheumatic neuritis was. It would be difficult to conceive of exposure to cold involving ocular nerves in their intracranical course.

He did not feel that these cases were rheumatic or purely toxic, because most toxic affections were bilateral, or at least more or less symmetric, whereas most of the palsies were unilateral, or certainly asymmetric. In the spinal cord, local collections of cerebrospinal fluid formed and compressed the roots of the nerves of the cord itself; similarly he thought loculated collections of cerebrospinal fluid might form in the base of the brain and there involve one of the oculomotor nerves.

He had seen cases of chronic nuclear palsy, one had weakness and limitation of eye movements in all directions, with bilateral ptosis. The intrinsic muscles were intact. The ocular palsy in this case was associated with wasting of certain other groups of muscles, especially those at the shoulder girdle, of the progressive muscular atrophy type.

Kraemer reports a case of injection of alcohol into the ganglion of the trigeminus, with bilateral paralysis of the abducens nerve.

Moore speaks of Graves' disease and spinal anesthesia as the cause of ocular paralyses. Under this heading a case is described and after reference to the literature, the conclusion is, that it seems probable that when deficient movement of the eyes occurs in Graves' disease, it is due to impairment of function of the muscles,—as a result of their infiltration by edema, or by fat, or perhaps both; and that marked exophthalmos when present, will introduce a mechanical factor, which will contribute toward the same effect. With regard to the ocular palsies occurring after spinal anesthesia, tho a somewhat rare complication, the dependence of the paralysis upon the anesthetic cannot be doubted. The abducens nerve is the one usually affected. **Clegg**, reviews the literature of paralysis in Graves' disease and **Dundas-Grant** reports abduction paralysis in exophthalmic goiter.

Wilson discussed the question of a possible unilateral cranial polyneuritis. A case had been reported, in which several cranial nerves were involved on one side only and a toxic cause suspected. The author's case was also suggestive of a cranial polyneuritis of toxic infectious character, altho there was no involvement of an ocular muscle or ocular nerve. Another case is recorded in contrast, to show the difficulty of determining the etiologic factor in these conditions. The conclusion is that unilateral cranial polyneuritis ought to be regarded as a clinical possibility.

Jendralski reports his observations in a case of injury of the trigeminus and facial nerves. A sixteen year old boy was shot in the head with a pistol in the hands of a companion. In consequence of the clinical manifestations and the Roentgen pictures, the author came to the conclusion that the ganglion Gasseri was injured.

Taylor said the most astonishing thing in connection with myasthenia gravis was its extraordinary variability in course. In some, the course was definitely and consistently downwards; in others the progress was very slow and variable; one day the patient might have complete command of ocular movements, the next day he might scarcely be able to carry out any combined ocular movements. At Queen Square he had had under his care a man, recently dead, whom he had been watching for ten years or more, in whom the variability of the symptoms had been very striking. In other cases, however, the course had been relentlessly downwards.

In the first case reported by **Grütter**, the following abnormal eye conditions were found: Pupils irregular, slow reaction and less extensive than normal. Slight lagging of the right eye on looking to the right. On looking up, the eyes converge with rapid movements especially of the right eye. In the second case, the left pupil was larger than the right, the reaction to light was absent on both sides, and there was bilateral optic atrophy, more advanced on the left side.

ASSOCIATED MOVEMENTS.—**Borries** expatiates on the theoretic importance of the case he described in which, with complete paralysis of the voluntary movements of the eyeball toward the left, the nystagmus elicited by way of the vestibule was absolutely normal both to right and left. He discusses the literature on the subject, saying that his case seems to belong to the subcortical group of ocular paralyses, according to Bárány's classification.

Henderson reports vertical conjugate paralysis of associated movements downwards. Miss A. aged 23 years. Very lethargic and sleepy, for the last few months. No headache, vomiting, or fundus changes. Pupils react well. Both eyes are rotated slightly upwards, and there is complete inability to move them below the horizontal meridian. On attempting to do so, a vertical nystagmus is induced. Since being exhibited, this conjugate paralysis has entirely cleared up.

Holmes reports, in attempting to determine the site and cause of a lesion which affects a conjugate movement of the eyeballs in any direction, we must keep before us the complex physiologic apparatus which regulates the normal movements of the eyes, for these occur not only in response to voluntary impulses, but also as reflex movements excited by peripheral stimuli arising in the retinae, in the ocular muscles, in the labyrinths, and even from auditory and cutaneous stimuli.

From the earliest days of experimental cerebral physiology, the existence of certain areas has been recognized in the forebrain, from the excitation of which associated ocular movements result. The best known of these cortical centers is that in the second frontal gyrus, which, when stimulated, causes conjugate movements of the eyeballs toward the opposing side. This area is generally regarded as a motor center for ocular movements, tho there is a difference of opinion as to whether purely vertical movements ever originate from this frontal area. A second cortical center has been described as located in the angular gyrus, but while this may be true as regards animals there is no positive evidence that it applies to man.

The frontal oculomotor center seems to be concerned with movements of the eyes which are initiated by volition; all the reflex movements remain intact when it is destroyed. It is, however, disease of the brainstem that produces the most complete and permanent, and, consequently, the most obvious disturbances of the conjugate movements of the eyes. It is well known that inability to move the eyes to one side is frequently associated with disease in the lower and dorsal portion of the pons Varolii, especially when it extends to the neighborhood of the abducens nucleus of the same side. It is difficult in many cases, however, to satisfactorily explain the lesion on the theory of association fibers between the nuclei involved. This has brought forth the hypothesis that a supranuclear center exists in the vicinity of the nucleus of the sixth nerve.

All impulses that can excite conjugate lateral movements of the eyes reach this center; in it they are probably correlated and coordinated to produce an adequate response, and by efferent fibers the resultant is transmitted to the motor cells by which the corresponding internal and external recti muscles are innervated. It is probably thru it too, that the antagonists of the contracting muscles are reciprocally inhibited.

Disturbances of the conjugate vertical movements of the eyes must be controlled in a similar manner. It is not uncommon for neurologists to see loss or limitation, equal in degree in the two eyes, of either upward or downward rotation, or of both, with the lateral movements intact. A study of all the possible explanations of such phenomena forces the conclusion that there are supranuclear mechanisms for upward and downward movements and for convergence, mechanisms which would in fact correspond to the associational cells, intercalated between the spinal afferent reflex fibers and the descending spinal tracts on the one hand, and the motor cells of the ventral horns of the cord on the other.

Conjugate Ocular Movements.—**Schuster** discusses four cases of paralysis of vertical ocular movements. On the basis of observations made by Senator, Anton, Roth, Kornilow, and the fundamental researches of Steinert, Bielschowsky and Bárány, Schuster demands that in paralysis of associated ocular movements the following tests should be made: Voluntary focusing of an object at rest; impulsive focusing of a sudden retinal stimulation of light; following a moving object with the eyes; following an acoustic stimulus with the eyes; moving the eye in passive antagonistic movement of the head ("doll's head phenomenon"); vestibular and optical nystagmus.

The lowest physiologic grade, preserved in all cases, is raising the eyes with firm closure of the eyelids. This "associated movement" is probably due to the simple anatomic union of palpebral ligaments and levators. A physiologically higher grade is the vestibular, and still higher the optical, nystagmus induced by the optical cortex. The same statement holds for the act of following a moving object with the eyes. On the other hand, the "doll's head phenomenon" is not induced by the cerebral cortex, but proceeds from the deeper cerebral areas. It does not proceed from the labyrinth, as demonstrated by case 1. The "doll's head phenomenon" thus belongs to the throat reflexes, studied by Magnus and de Kleijn, incited by the sensible stimuli arising in movements of the head. In normal subjects this phenomenon is usually absent, and we are, therefore, led to suppose that the process of retaining this position is possibly a secondary, perhaps reflexly or partly voluntarily excited. The "doll's head phenomenon" would then become the more marked if the effect from the central volition tract were lost.

Mayou saw two patients with paralysis of associated movements in the vertical plane. He said it had never been his fortune to come across similar cases before, but by a curious coincidence he had seen two cases in less than six months.

In the literature on the subject, he had been able to find about six cases, two reported in this country, one by Lang and one by Fitzgerald. The sudden onset of the lesion associated with straining suggested that it was due to hemorrhage. The actual situation of the lesion had been variously stated to be in the optic thalamus, the corpora quadrigemina, the pons, and the subcortex. As far as he could discover none of these lesions had been verified by postmortem examination.

Fisher recently saw, in a man past middle age, a case of complete inability to elevate either eye above the horizontal position, accompanied by all the symptoms of exophthalmic goitre with the exception of swelling of the thyroid gland; besides the ophthalmic evidences, he had a rapid pulse, tremor, and the general bearing of a patient with Graves' disease.

Harris reported the case of a man who developed acute symptoms, possibly due to disseminated sclerosis, as his articulation resembled that met with in this disease; he also had ophthalmoplegia. He could not look upward at all above a horizontal line, but could look downward quite well. In making conjugate movements to the left or to the right, the outer eye went to the canthus, with nystagmus, but the inner eye scarcely went beyond the midline, and in it there was no nystagmus. That, he thought, was probably due to interruption of the posterior longitudinal fibers.

CONJUGATE PARALYSIS.—**Velter** and **Cousin**, report a case of a hunter shot in both eyes. A radiograph showed many pieces of lead in the head one of which was in the left temporal fossa. Three weeks after the injury, the patient presented deviation of the head and conjugate deviation of the eyes to the left. He complained of headache, the spinal fluid showed an increase in the number of lymphocytes and the spinal Wassermann was positive. Further there was definite history of antecedent syphilis. After treatment the deviation of the head diminished, but the deviation of the eyes persisted. The authors thought that the contusion limited to the Rolandic region had favored the development of the specific lesion, but Morax believed that it was only a coincidence.

Saenger contributes to the problem of *conjugate deviation* of the eyes by collecting and grouping similar cases with autopsy findings, as reported in literature and observed in his practice. Among 78 cases, conjugate deviation occured in twelve cases of genuine diseases of the frontal brain; in 4 cases the frontal and temporal lobes were affected; in 14 cases the focus extended from the frontal to the parietal lobe; 6 cases showed genuine parietal lobe foci. In one case the focus extended from the parietal into the temporal lobes, while in five cases the temporal lobes only were affected. In 10 cases lateral deviation was observed in diseases of the occipital lobe which extended to adjacent brain areas. No foci were observed which were strictly limited to the occipital lobe. In one case the focus was located in the oval center. In 18 cases foci were found in the major ganglia, particularly in the inner capsule.

Saenger holds that neither animal experiments nor clinical observations solve the problem of the localization of conjugate deviation, since positive cases are always confronted with numerous negative cases. Saenger assited in three surgical operations of extensive tumors of the frontal brain, and the clinical observations before and after operation testify to absence of lateral deviation of the eyes and ocular paralysis. Saenger also holds that lateral ocular movements may originate in very different regions of the cerebral cortex. Local diagnosis of lateral deviation has slight significance. It depends on the different location of the focus in the brain, is due to injury of the long fasciculi of fibers and not of a single spot, and it is often difficult to distinguish whether conjugate deviation in a given case should be considered a symptom of reflex (Ausfall) or stimulation.

Classification of Paralysis.—As a basis for this paper **Paton** classifies the oculomotor paralyses in three main groups:

I. Paralysis of central or cerebral origin, comprising three subgroups: (1) supranuclear lesions; (a) cortical; (b) subcortical. (2) Internuclear lesions. (3) Nuclear and nerve root lesions. II. Paralyses of extracerebral origin, i. e., of nerve trunks, again comprising two subgroups: (1) Intracranial. (2) Intraorbital. III. Paralyses of muscular origin.

A clinical classification of ophthalmoplegia is then made:

1. Acute and subacute ophthalmoplegia; (a) poisons; (b) infective agents; (c) trauma; (d) no etiologic factor.
2. Chronic (progressive) ophthalmoplegias; (a) an isolated lesion; (b) tabes and general paralysis; (c) disseminated sclerosis; (d) bulbar palsies, progressive muscular atrophy and myasthenia gravis; (e) Graves' disease; (b) diabetes.
3. Congenital ophthalmoplegia of nuclear origin.
4. Unilateral ophthalmoplegia.
5. Recurrent and alternating ophthalmoplegia of nuclear origin.

The muscular conditions attending each of these affections, considered from the clinical point of view, is then presented in detail and a long bibliography is appended. .

Paton said that the subject of ocular palsies was one of extreme complexity. One disease alone, syphilis, was capable of producing an ocular motor paralysis in numberless different ways. It might affect any part of the oculomotor apparatus, cortical, supranuclear, nuclear, nerve roots, nerve trunks in their intracranial course, in the cavenous sinus or in the orbit, or it might affect the muscles themselves. A gumma might develop at any point. A syphilitic meningitis might affect the nerves. Syphilis sets up disease of the vessels, and they might get hemorrhages affecting the nuclei or nerve roots, or a syphilitic arteritis in the internal carotid might press on nerve trunks in the wall of the cavernous sinus or an endarteritis might affect the vessel supplying the curcura, the midbrain or the pons, and give rise to areas of softening; or syphilis might give rise to tabes or general paralysis, and to all the variety of ocular disturbances arising in these diseases. Yet it was doubtful if more than 40 percent of cases of ophthalmoplegia were due to syphilis, directly or indirectly.

Paralysis of Convergence.—**Israel** reports three cases. Before making a diagnosis of paralysis convergence, it is necessary to differentiate between: 1. Convergence insufficiency. 2. Paralysis of the individual muscles (internal recti). 3. Divergence excess.

Paralysis of Divergence.—**Ralston** and **Goar** reports a case. A man, aged 41, while driving a car suddenly became aware of diplopia; an approaching automobile looked like two cars until it was very close and then merged into one. Double vision continued from that time. There was esotropia of 20° at 6 meters, with the left eye fixing and the right converging. At 25 cm. there was an esophoria of 2°; with red glass and light, an homonymous diplopia amounting to 24 inches at 20 feet. As light was brought nearer the images approached and binocular vision resulted at 19 cm. With a 14° prism he could fuse the light at 20 feet. Syphilis was not proven, but improvement is taking place under mercury and iodid.

RETRACTION MOVEMENTS.—**Freytag** reports a case of congenital retraction of the eyeball. Male, 29 years of age, slight left facial asymmetry; left enophthalmus (2 mm.), narrowing of left palpebral fissure (1 1/2 mm.), normal eyeballs, left medullated nerve fibers. Very slight active abduction of left eye with simultaneous widening of the palpebral fissure (1 mm.), very slight active adduction of the left eyeball with simultaneous marked lowering and retraction (5 mm.) associated with 3 mm. reduction of left palpebral fissure. Left eye can be passively abducted and adducted. Cause: probable abnormal insertion of the median rectal muscle too far back on the sclera; possibly also a retractor muscle of the eyeball existing as an atavistic phenomenon.

PARALYSIS OF THE SUPERIOR OBLIQUE.—**Rousseau's** patient was struck in the right eye by the horn of a cow, resulting in a hematoma of the lid and conjunctiva, and diplopia due probably to a lesion of the pulley of the right superior oblique. The right cornea was 3 or 4 mm. lower than the left, and motion upward was limited without any involvement of the right upper lid. This was explained by supposing an injury to the accessory tendon of the superior rectus which, according to Motais, is given off from the inner border of the superior rectus, 27 or 28 mm. from the apex of the orbit, to be inserted into the pulley of the superior oblique. Treatment; ground glass lens was worn, and three months later the diplopia had completely disappeared.

Vitrac reports fracture of the right occiput, left cerebral lesion and rare oculomotor paralysis by contrecoup. During the first ten days, the patient showed signs of general and bulbar concussion with vomiting, tendency to have slow respiration and somnolence. In the following days, diplopia appeared, then right sided paresis most marked in the region of the right hand. Careful examination of the eyes demonstrated paralysis of the fourth nerve, probably the result of simple contusion by contracoup in the region of the motor nuclei of the fourth pair. The paresis and the diplopia regressed progressively, which is also in favor of contusion.

OCULOMOTOR PARALYSIS. — **Laignel-Lavastine** saw a patient with *Parkinson's Syndrome* with paralysis of the motor oculi of infectious origin. Following an attack of fever, the patient suffered with paralysis of the third nerve, ptosis and right divergent strabismus, in addition to Parkinson's disease. The paralysis of the oculomotor cleared up. The cause of the condition was probably an infectious focus in the region of the peduncles. **Mulholland** saw a case of third nerve paralysis in a child aged four years.

Vail's patient was a man of 50 years; within 24 hours there appeared exophthalmos and paralysis of the motor oculi. The fundus, vision and visual field were normal. The X-ray showed a cloudiness of the right ethmoid. The operation, which was intranasal, yielded a large amount of yellow pus from the posterior ethmoid, and was followed by a cure in ten days.

Bistis discusses recurring paralysis of the oculomotor nerve. The recurring paralysis affects the poor classes, begins in infancy, and gets worse with age. It has been attributed, by different authors, either to an inflammatory or neoplastic process of the nerve or surrounding meningitis, or to a peripheric neuritis of the common oculomotor nerve, with tendency to recurrence, or to an affection of the region of the nuclei; also the hypothesis of basal irritation, blood alterations and tumors have been postulated.

Allen saw a child who was brought into the hospital with a divergence of the right eye, drooping of the right lid, nausea, vomiting and headache. The diverging attacks began about three years ago and recurred every week to every month. There was one long attack lasting eight days, the others lasting only three to four days. Wilder, in discussion, said that these cases must be very uncommon. He thought he had seen but one before, and that seemed to be of the kind that was described by the neurologists as recurrent palsy occurring with migrain.

RECURRING OCULOMOTOR PARALYSIS.—In reviewing the literature of this condition, **Danis** points out that it is not very common. He reports the case of a man of 40 who had suffered from attacks of migrain with diplopia since 14 years of age. The violent headache occurred on the right side; there was homonymous diplopia and convergent strabismus, the right turning in and the head being turned towards the right. The diplopia reached its maximum on the first or second day, and diminished gradually to disappear in a fortnight. The attack was marked by no abnormality of the pupils or other ocular structures. The patient was somnolent, nauseated, unfitted for work. The attacks recurred at intervals of usually three to five months, never more frequently than once a month. Personal and family history threw no light upon the cause, but analysis of the urine seemed to indicate a connection with recurring periods of intestinal autointoxication.

Somer reports a similar case in a man of 23 whose first attack in 1917 had followed sleeping in very cold barracks. The second attack occurred three years later, and the third about 7 months after that. From each attack the recovery was complete, and he was free from headache in the intervals. Somer believes that Wilbrand and Saenger are both right in regarding this as a symptom complex arising from various pathologic causes.

Marin Amat reports a case of ophthalmoplegic hemicrania, followed by sensory-sensitive-motor ophthalmoplegia on one side, optic atrophy on the other, and death. Besides the fundamental symptoms—paralysis of the third pair and neuralgia of the trigeminus—there were many accessory symptoms; reduction of the visual field, bilateral paralysis of the second pair, optic atrophy and monolateral paralysis of the fourth, fifth, sixth and seventh cranial pairs, convulsions, loss of memory and tendency to sleep; the patient died during the progress of the disease. The most interesting part of this case is the reference to the localization, as the lesions, of meningeal origin, inflammatory, hemorrhagic and neoplastic, were in the internal portion of the middle cerebral fossa, the region from which ophthalmoplegic hemicrania gets its name.

Mancini saw a patient with sarcoma of the posterior mediastinum with metastasis into both oculomotor nerves and hypophysis. There was total bilateral ophthalmoplegia.

Viaud saw a boy 17 years old who developed paralysis of both irides, diplopia, photophobia and severe headache 3 days after eating canned pate de foie gras, which had spoiled due to imperfect soldering. Elimination and two weeks rest completely cured the patient.

Blaxland saw a patient aged 11. Four years ago he was treated by Wilson, of Portland, for infantile paralysis. The first symptoms were drowsiness and a dragging of the right leg, while the right eye was turned upwards. There is still some paresis of the inferior rectus muscle, which was more marked before the instillation of atropin.

Henderson's patient gave a history of blow on right side of head followed by complete paralysis of the third nerve, right eye. This was only partially cleared up, as there is complete loss of function of the superior and inferior recti.

OPHTHALMOPLEGIA.—**Collier** speaks of migrainous ophthalmoplegia and asthenopic diplopia. This trouble occurs only in long standing cases of migraine. The onset is sudden, following a headache of greater severity than usual. The weakness of the ocular muscles may last four years, lessening between the attacks and being exacerbated by each succeeding attack. With regard to ophthalmoplegia from inflammatory lesions of the orbit, the sixth, fourth, third and the first and second divisions of the fifth nerves are affected. The condition is not due to syphilis or to septic conditions of the sinuses. It invariaby recovers. Ophthalmoplegia due to congenital absence of an oculomotor nerve may be diagnosed by the absence of diplopia, and by the perfect vision of the erring eye.

Foix warns that disease in the external wall of the cavernous sinus should always be suggested by rapidly progressive unilateral ophthalmoplegia accompanied with pain in the region of the ophthalmic nerve. The absence of disturbance in the circulation, and negative roentgenoscopy should not exclude this assumption. Necropsy revealed a sarcoma in one of the two cases reported, located in the posterior lobe of the pituitary. The paralysis had begun in both in the sixth pair, and had then involved the third and fourth pairs. In the second case a tumor was removed which had been encroaching on the rear wall of the sphenoidal sinus and the patient is still being given prophylactic radiotherapy. The above symptoms should suggest the advisability of intervention with access thru the nose. This may cure a sphenoidal lesion and mitigate in case of a tumor beyond.

Gardner examined a man 35 years of age. Patient noticed no abnormality in left eye until four months ago. Then became conscious of a mist. No pain until three weeks ago. Noticed left eyelid beginning to droop fourteen days ago. Previous history: Syphilis eighteen years ago. Three years' continuous treatment. Has had no recurrence. No headache, vomiting, or loss of memory.

Present condition: Complete external and internal ophthalmoplegia L.; L. ptosis; no P. L. Fundus normal; slight proptosis. No evidence of other cranial nerves being affected. Cornea not anesthetic. Teeth bad. General reflexes normal. Wassermann test positive.

A patient was seen by **Onuf** and diagnosed as lethargic encephalitis with resulting bilateral ophthalmoplegia and a slight titubation of gait, besides some muscular disturbances but later he was in doubt as to whether they were the result of encephalitis, or due to a juvenile muscular atrophy.

Den Boer reported a case that in her 21st year suffered from swelling of the neck and loss of weight, a choking sensation in her throat, loss of hair and sleeplessness. There were days when it was almost impossible for her to keep her eyes open. When she was 31 years old, ptosis developed. The patient had six healthy children. Examination shows to the left of the middle thyroid region an immovable mass. The patient was not hoarse. Slight exophthalmos. Operation. After operation her throat swelled again, and ptosis returned. This patient showed enlargement of the thyroid with almost complete paralysis of the external eye muscles, a slight paresis of the right facialis.

Crouzon and **Béhague** report the history of a family with *congenital ophthalmoplegia* in three generations. Some of the observations have been published. In the first generation, one daughter and one son was unaffected, and one daughter was affected. Of her five daughters and two sons, two daughters and one son were affected. The details of the paralyses are given in each case.

Another patient of theirs, age 72, had bilateral congenital ptosis. His father since the age of 30 had the same condition following cramps. Two sisters of the patient had the same condition. On the other hand, four brothers and their children had normal eyes. **Wold** reports a case of diphtheritic paralysis of accommodation with rapid recovery.

Bergmeister emphasizes the difficulties confronting the ophthalmologist in trying to ascertain the causes of paralyses of the ocular muscles, especially when the case is one of syphilis in the early secondary stage. A rheumatic paralysis can only be diagnosed with marked reservations, even when no meningeal affection, or periostitis of the bony canal can be indicated as a cause.

The author emphasizes the importance of examination of the spinal fluid in all cases.

Den Boer reports the case of a multipara, forty-four years of age, with three scrofulous cysts in the thyroid gland, causing almost complete external paralysis of the ocular muscles, slight paralysis of the right facial, the left recurrent and hypoglossal muscles and some functional deviations.

Fiorenza described three cases of ophthalmoplegia in three brothers, 16, 19, and 30 years of age. Two of them were partial external ophthalmoplegia and the other complete external ophthalmoplegia. The Wassermann reaction, the luetin reaction and von Pirquet's test were negative in all the brothers and in their mother. There was no history of syphilis, tuberculosis or alcoholism in the family. The only history of nervous disease was one of convulsions in the maternal grandmother.

This condition is due to congenital aplasia of the nucleus of origin of the oculomotor nerves. The author divides them into four groups: 1. Nuclear aplasia, in which the nucleus is not developed at all. 2. Intrauterine nuclear dysplasia, in which there is an arrest of development in fetal life, probably due to infection. 3. Natal dysplasia, in which there is injury of the nucleus at birth by dystocia, forceps delivery or asphyxia during delivery. 4. Postnatal dysplasia from unknown causes, which may take place up to five years of age, as the nervous system is not completely developed before that age. The etiology of these defects in development is unknown, tho hereditary syphilis is undoubtedly a factor in some cases. Some observers believe that hereditary tuberculosis and alcoholism may be causative agents. None of these causes, however, was present in the author's cases.

Ginestous has seen a patient 14 years of age with congenital ophthalmoplegia. The family history and previous medical history were negative with the exception of a fall at the age of 18 months, which apparently had nothing to do with the condition as the ocular symptoms antedated it.

The examination revealed a slight facial asymmetry—the right eye appeared larger than the left—slight nystagmus of both eyes. Motility was conserved in elevation and depression, but completely abolished in abduction and adduction—Wassermann was positive. It appeared to be an external ophthalmoplegia with double associated paralysis, and paralysis of the right internal and external rectus on each side. This paralysis was congenital. The injury could not have been considered as a factor, and syphilis as a factor is questionable. In the presence of the positive reaction, specific treatment was instituted, which did not change the oculomotor paralysis. It is probable that nuclear lesions existed. This hypothesis is more acceptable, due to the fact that the nucleus of the internal rectus is automatically connected by a tract with the right internal rectus of the opposite side; the paralysis of the one is associated with paralysis of the other.

McMullen and **Hine** stated that in the text-book on "Neurology of the Eyes," published in 1899, Wilbrand and Saenger had grouped as a clinical entity certain cases of external ophthalmoplegia which, in their opinion, had certain definite characteristics which separated them not only from the congenital cases of this affection, but also from the cases definitely due to some toxic cause, or to syphilis, or associated with some manifestations of more widely spread disease of the nervous system. The cases thus grouped, these authors stated, had the following characteristics:

1. Onset was gradual, usually in infancy or early life, more rarely in later life. 2. The ophthalmoplegia was bilateral and very slowly progressive. 3. There were no other signs of disorder of the nervous system, and there was no affection of the general health. 4. The disease might come to a standstill permanently, or for long periods at any stage in its development, but generally ended in complete or nearly complete external ophthalmoplegia.

McMullen and Hine were able to show two cases which seemed to tally with that description, while a third patient who had recently come under their observation unfortunately lived too far away in the country to be shown with the others. **Clark** reports total ophthalmoplegia with acute meningitis.

Spasms of Ocular Muscles.—**Brunner** discusses cases of malposition of the head and eyes and states, concerning the labyrinthine origin of clonic spasms, that "diseases of the labyrinth may produce in the human subject phenomena similar to those observed with labyrinthine injuries in animal experiment." While, however, the phenomena of rotatory vertigo, nystagmus, inclination to falling phenomena, concerning the entire labyrinth, are regularly associated both in man and animal with labyrinthine disease, the purely otolithic phenomena of clonic spasms and forced malpositions of the head and eyes are observed in the human subject only if there is individual disposition to these spasmodic types; or in other words, if the individual affected is unable to overcome his inclination to these spasms.

Monchy reports rhythmic convergence spasms of the eyeballs in a boy of 14 years, which are not so frequent or regular as in nystagmus. There is also convergent strabismus, but there are no signs of meningitis. A tendency to choreic athetosic movements, slight incoordination of the fingers, and a slight tendency to scanning speech suggest some disturbance in the region of the corpora quadrigemina.

Congenital Nystagmus.—Two cases of latent congenital nystagmus are reported by **Hairi**, who reviews the literature relating to it, and discusses the various theories propounded to account for it. He finds that it was first described under this name by C. and H. Fromaget. It may be provoked by covering one eye and other circumstances. It is defined as the movement of one or both eyes manifest when one is covered. The two phases of nystagmic movements are due, the slow to the influence of a supranuclear center, the rapid, to the influence of a cortical center. The covering of one eye supresses the influence of the supranuclear center of the opposite side. The nystagmus is diminished by turning the affected eye to the side of the eye that is covered and increased by turning in the opposite direction.

Clinical Aspects of Nystagmus.—**Fernandez** saw a woman forty years old, who while preparing breakfast one morning, felt as tho she were going to collapse, and called for help. She was put to bed. Nystagmus of the left eye was noted from then on, and the professors who saw her attributed it to hysteria. There was no twisting of the mouth, but there were zones of hyperesthesia and anesthesia in the right leg.

When the author was called, he attributed the nystagmus to hysteria. He has followed this case for eighteen years, and now would like to rectify his original diagnosis of hysteric nystagmus. He has been influenced to do this by an article published on cerebral nystagmus by Argañarez. After reading the article, he has decided that the symptoms were purely cerebral; there were localized lesions at definite points of the cerebral cortex. Everything seems to show that the conjugate displacements, the paralysis of association and the nystagmus really represent symptoms of localized lesions. The fact that in this patient, after eighteen years, the nystagmus still persists, strengthens the author in his opinion that it is not a case of hysteric nystagmus, but a case of cerebral nystagmus.

Hautant has studied reflex nystagmus. Flourens in 1828 stimulated the semicircular canals of a pigeon, and provoked movements of the eyes, head and body. In man the same movements provoke only nystagmus. He defines nystagmus and suggests methods for eliciting nystagmus. One of particular interest is to use ground glass lenses so the patient may not converge or fix. He draws attention to the method of Buys, who places two drums against the closed eyelids and by suitable apparatus makes a tracing which he calls a "nystagmogram." Various methods for eliciting reflex nystagmus, and theories of the mechanism, are considered. Finally, reflex nystagmus, as it is affected by lesions of the vestibulo-oculomotor pathways, is outlined. This work is a scholarly resumé of a difficult subject.

Jensen described a case for differential diagnosis between nephrosis and brain tumor. During the early stages of the disease, there were present left abducens paralysis, lasting four weeks, and severe optic neuritis, which on the left side was accompanied by white striae in the macular region, but no typical sign of albuminuric retinitis. Later, there was slight ptosis accompanied on the right side by nystagmoid movements on looking up or to the side. The question to be decided was whether it was a case of nephritis with secondary brain lesions, or with a coincident nephritis and brain tumor. There is the possibility of a nephrosis due to brain tumor. No autopsy.

Lloyd urges the more universal employment of the Bárány tests as an aid in diagnosis for the ophthalmologist and neurologist as well as the otologist. To Mackenzie is credited the observation that ocular nystagmus is oscillatory but may become rhythmic on looking in an extreme direction. It has been too frequently stated that all ocular nystagmus is oscillatory.

After a brief review of the problem of vestibular innervation, **Ohm** proceeds to an exposition of the influence of sight on vestibular reactions. Every excitation of the retina finds its expression in the vestibular "tone" of the external eye muscles, but in such a hidden way that it has only lately become possible to observe it with the help of exact registration of nystagmus.

Light, as such, has an influence on the innervation of the external eye muscles. For these investigations the nystagmus of miners offers the best material, because it registers well under the most different circumstances. Not only the intensity of the retinal excitation, but also the sharpness of the images is expressed in the external eye muscles.

In conclusion, the author states that if one understands muscle tone as a reflex tension, conditioned by excitation of the sensory nerves, then there exists also such a "tone" for the external eye muscles, which is maintained by the vestibular and sight nerves. The source of this tone is to be sought further, especially in the trigeminus and the nerve of hearing.

Quix writes on the influence of caloric stimulation of the labyrinth on the eye muscles. Syringing both ears with cold water produces identical contractions of all eye muscles, but in ocular paralysis it effects no change in the position of the eye.

Schaller has made a clinical and anatomic study of a vascular lesion of both cerebellar hemispheres. J. E. S., aged fifty-eight, was first seen December 7, 1911. His illness began with a sudden onset three years before, in Japan, without previous ill health or warning. Seated in a tea house he experienced a sensation as tho he had been struck "by a ball of lightning in the knees." There was no loss of consciousness, pain, headache, nausea or vomiting. Incontinence of urine immediately followed the attack, later there was imperative micturition. He was unable to walk, and control of his left arm and leg was practically lost for all voluntary movements. The right arm and leg were affected to a lesser extent. He spent his days in a wheel chair. His speech was slow and deliberate. His hearing was dulled and vision was affected for near objects, but not for distance. The patient was unemotional and there had been no change in his disposition or mentality during the three years. Except for his loss of muscular control and imperative micturition, he was in average health.

Venereal infection was denied, and he did not use alcohol, but smoked in moderation. His speech was typically scanning; but there was no dysarthria. The most striking symptom was that of cerebellar catalepsy. Because of the history and the characteristic cerebellar symptomatology, which was predominant on the left side, a diagnosis of a vascular lesion in the left cerebellar hemisphere was made.

The patient died suddenly February 15, 1912. In this case there was destruction of tissue in both cerebellar hemispheres, with conservation of the vermis and the central vestibular system. Dyssynergia, cerebellar catalepsy and scanning speech had been marked, and the absence of spontaneous nystagmus and of spontaneous errors of pointing after Bárány equally marked. The absence of nystagmus is explained by the practically intact vestibular system. The patient had been able to maintain a sitting position with ease. Cerebellar catalepsy in this case is an example of conserved static equilibrium contrasted with disturbed dynamic equilibrium, exemplified by the great incoordination in the extremities.

Steuber reports a case of sarcoma of the cerebellum with autopsy findings. The various disturbances from cerebellar tumors are most marked immediately after the inception of the lesion. They gradually diminish in intensity and in some cases disappear, compensation being taken care of by the uninjured tissue. Tumors of slow growth may be almost overshadowed by compensation.

A boy, aged eight, weight 54¼ pounds, was first seen February 5, 1918. Family history good except on the maternal side a great aunt had recently died of cancer of the stomach. When an infant the child's baby carriage had upset, the fall rendering him unconscious, and he did not breathe for a time. In June, 1917, he commenced to vomit in the mornings. That autumn, complained of diplopia. Four weeks ago discontinued school. Every morning has a vomiting attack. He walks along a straight line with difficulty, his tendency being to sway and swagger towards the left. There is diplopia, vertigo and Romberg sign is positive. Vision—O. D. 20/20, O. S. 20/25: nystagmus, cerebellar in origin, associated with vertigo and vomiting, demonstrates the destruction of the fiber tracts between the vestibular nuclei and the cerebellar nuclei.

Feb. 20th, 1918, the child had responded to treatment and was much improved. The improvement continued until when seen June 1st. He was then listless following an attack of grip. On June 17th, he complained of pain in his head. The cerebellar type of gait was pronounced. Vomits daily. His conversation was explosive in type. Atonia, dysmetria and ataxia of the right arm of the cerebellar type. On August 9th, 1918, in a consultation with Dr. Carl Camp, the diagnosis was a brain tumor probably in the region of the cerebellum, more probably in the cerebellar peduncles.

January 7th, 1919, the patient was helpless in bed. There was a complete loss of the functions of both arms, which had developed during the past four weeks, also marked jerking movements of the limbs. Nystagmus was more marked. The child died January 23rd, 1919. The autopsy revealed a small round cell sarcoma of the cerebellum. It may be considered as arising from an especial congenital "anlage." Ziegler says trauma not infrequently gives the immediate occasion for the beginning of the development of the tumor from such anomalous tissue. A noteworthy point in the case was the 20/20 vision with marked fundus changes.

Weisser discusses the clinical significance of nystagmus. A true nystagmus may be described as a short, rhythmic, involuntary, more or less jerky tremor; usually binocular, ranging from 1 to 4 movements per second and from 1 to 5 mm. in width. Occasionally is seen a mixture of the lateral and rotatory movements. Early cases usually exist from infancy, and depend upon amblyopia as the result of opacities of the cornea or the media, and diseases of the fundi. Ophthalmia neonatorum is the principal cause of nystagmus from scarring of cornea. Retinitis pigmentosa, central choroditis and coloboma of the optic nerve or choroid are the principal diseases of the fundi causing nystagmus.

Nystagmus of adolescence and adult life is grouped into three subdivisions: 1. Nystagmus from diseases of the nervous system. Multiple sclerosis is the principal cause and nystagmus is present in from 12 to 50% of the cases. 2. Occupational nystagmus, as miners' nystagmus. 3. Otitic nystagmus due to certain diseases of the middle and inner ear.

Weve and **Sonnen** draw some interesting conclusions from a study of the influence of caloric labyrinth stimuli on the position of the eye in ocular paralysis. Bilateral, equally potential cooling of the outer meatus, is no serviceable proof of determining paralysis of the right eye muscles.

Nonappearance of nystagmus in bilateral, equally potential cooling of the meatus apparently is not caused by incited muscle contractions tho they maintain accurate equilibrium; on the contrary, the intended contractions seem to be totally missing.

Bilateral equally potential cooling of the meatus induces nearly no phenomenon of rotation causing sickness; this is in remarkable contrast to unilateral cooling. Simultaneous as well as crossed unilateral cooling of the labyrinth induces with unilateral paralysis of the abducens nerve nystagmus in the affected eye also, which, however, principally differs in the following points: (a) The median line is not crossed in looking to the right; (b) In cooling the meatus of the same side, instead of coinciding with nystagmus the experimental subject looks toward the side crossed by the paralysis. (c) In cooling the crossed meatus, we have instead of a striking disagreement with nystagmus, the experimental subject looking toward the side of the paralysis; in the affected eye nystagmus is then almost impeded, while it is very distinct in the normal eye.

Unilateral cooling of the labyrinth is in some cases of ocular paralysis good for special tests of differentiating between functional and organic ocular paralysis. In paralysis of the ocular muscles, phenomena of the nystagmus may be explained by assuming that the slow phase is due to contraction of the positive muscle, plus weakening of the antagonist, while the quick phase is ascribed to a weakening of the first muscle, plus tonus recovery in the antagonist.

Wilson says that nystagmus is associated with conditions that produce imperfect retinal images. Impulses that normally pass to the visual center are reduced or are practically absent. The visual center is probably part of the cortical mechanism that directs and controls ocular movements, and if this mechanism is deprived of its normal stimuli, then it may be reduced thru lessened activity to abeyance of function. The lower centers would then be uncontrolled. The movements of the eyeballs—rhythmic and irregular—manifest the absence of the orderly cortical quality. Nystagmus associated with injury to the visual center does not seem to have been reported. It would be interesting to have recorded, the observations of those who have seen cases of nystagmus produced in nonminers by shell-shock, with or without obvious trauma.

Bollack calls attention to certain previously mentioned characteristics of of the visual disturbance of *epidemic encephalitis,* such as isolated paralysis of the accommodation with integrity of the pupillary reflexes and ptosis which seem to spring from a disturbance of muscular tonus. In connection with the disturbance of associated movements, the author speaks of nystagmus. He says that, in general, there is no true nystagmus. Most of the time they are nystagmiform movements which which are only revealed by the displacement of the gaze horizontally or vertically, often in extreme positions. Clinically speaking, the nystagmiform attacks are important, since by their frequence they constitute a diagnostic sign of great value.

As an additional diagnostic factor in the determination of hemianopsia, **Bárány** suggests the use of railroad nystagmus. Normal eyes will show nystagmus toward either side when objects pass before them in rapid succession; in hemianopsia, the eyes will show nystagmus only toward the unaffected side. A practical mechanism for the employment of this test, is an arrangement whereby a cylinder striped black and white is made to rotate before the eyes. In cases of right sided hemianopsia, rotation of the cylinder toward the left will produce a left sided nystagmus, but nystagmus will be absent on rotation toward the right. Railroad nystagmus is also of value in differentiating a spontaneous nystagmus from that of vestibular origin. The latter is completely suppressed by railroad nystagmus, while the former is unaffected. Should the spontaneous nystagmus be of the vertical kind, a horizontal railroad nystagmus can then be induced.

It is interesting to note that the same phenomenon is present in newborn infants, thus arguing against Flechsig's theory that unmyelinated nerves cannot function; for in fixing on the moving cylinder, the newborn shows its use of the region about the calcarine fissures. Railroad nystagmus is a reflex composed of three mechanisms; fixing the object, following its movement, and returning to the new stimulus. These impulses most probably originate in the region of the calcarine fissure.

Pentimalli has studied nystagmus from *protein intoxication.* The theory that all the symptoms of *anaphylaxis* may be attributed to acute intoxication of the nervous system, has been expounded by Richet and confirmed by Besredka, with experiments proving, that ether anesthesia prevents anaphylactic shock, as it excludes the central nervous system. This theory found opponents in Auer and Lewis, who stated that the death of animals from anaphylactic shock is due to asphyxia. This view was confirmed by Biedl and Kraus, who admitted that the anaphylactic toxin exerts an action on the nervous ends of the bronchial muscles.

Richet, while admitting the occurrence, in a moderate degree, of such a phenomenon, reaffirmed that the principal fact is an acute intoxication of the nervous system. Recent experiments have demonstrated that in rabbits suffering from chronic protein intoxication, anaphylactic phenomena frequently occur, associated with a symptom revealing beyond doubt the participation of the nervous centers. This symptom is nystagmus.

It may occur, together with other anaphylactic symptoms, such as convulsions, dyspnea, etc., or it may represent the sole phenomenon of protein intoxication. Sometimes it may be associated with swaying of the head of the animal; sometimes with dilatation of the iris, and may be either reduced or suppressed by the action of ether. It may last from a few minutes to a few hours. Recent researches interpret the nystagmus as a symptom belonging to a syndrome of labyrinthine origin.

The article on nystagmus, by **Lafon,** is a continuation of a previous one. (A.J.O., 1921, vol. 4. pp. 149-151). The first point discussed is nystagmus and spasmus nutans. There are three forms of the latter, of which only one is associated with nystagmus, viz., rotation of the head around the vertical axis. It usually disappears about 2-3 years, rarely persists until 7-8, but the author has seen it at the age of 30.

MONOCULAR NYSTAGMUS.—According to the literature, this condition is very rare. The author reports 3 cases. He has studied the action of sleep and narcosis on congenital nystagmus. As far as can be determined, nystagmus ceases during sleep. During narcosis, it ceases before the disappearance of the reflexes, and does not commence until consciousness reappears. Seventeen cases of voluntary nystagmus have been reported, including one of the author's. He regards it as a disturbance in the tonic equilibrium between the contracted muscles, due to an excessive attempt at convergence.

Pathologic nystagmus, according to **Kestenbaum,** is nothing less than an abnormal course of the normal reflexes for ocular movements. He divides nystagmus into 3 large groups: (1) Nystagmus due to disturbances of overaction of the vestibular apparatus —Vestibular nystagmus. (2) Nystagmus due to abnormal course of the fixation reflex—Fixation nystagmus. (3) Nystagmus due to a weakness of the "balancing" mechanism — Balancing nystagmus. The first two varieties are characterized by slow movements; the last one by very quick and easily exhaustible movements. These three groups are then subdivided.

Not infrequently one patient may present combinations of these various forms of nystagmus. A study of the movements will permit an analysis of all the components that make up the nystagmic movements, from which deductions as to the precise mechanism involved can be made. The results obtained will then be very helpful in determining the anatomic localization of the lesion, which may, in a given case, be the basis of this symptom.

Dissociated nystagmus, according to **Pekelsky,** is caused by vestibular paralysis of the ocular muscles. That is to say, in the eye whose amplitude of the movements in nystagmus is contracted, or their frequency decreased, we have before us paralysis of the vestibular nerve of the ocular muscle causing, by contraction, the slow component of ryhthmic nystagmus. The rapid component of nystagmus is due to the nuclei of the ocular muscles.

Ohm describes a case of nystagmus and strabismus acquired 10 years ago, with 33 explanatory tables and curves. Pseudomovements of objects seen were still present. Number of spasms depended on ocular position, and was least in the middle vertical plane with the eye markedly raised. If the spasms exceed 300, nystagmus changed from a jerking to a pendular movement. The spasms lasted longer in the dark than in the light and changed with every change of illumination. The initial spasm was almost obliterated from the strain of ocular accommodation and convergence. Ohm assumes a vestibular origin for this case, and believes that the intracranial area of the vestibular nerve or its nuclear area is disturbed.

From cases reported, **Brunner** concludes that irregularities, especially lapse of the rapid component—occur in the course of nystagmus if any portion of the reflex arc between eye and ear is injured without causing total interruption. It is not proved that irregularities in the course of nystagmus arise when bilateral interruption has occurred of the tract between ocular centers and primary nuclei of ocular muscles, that is destruction of the ocular center proper. All ocular reflexes may sometimes lapse in vestibular stimulation. On the basis of exact clinical and histologic findings of a case, Brunner concludes that vestibular ocular reflexes may be also absent with a chiefly unilateral focus. In experimental stimulation of the vestibular apparatus, nystagmus may be totally absent if (1) the two longitudinal bundles be completely destroyed; and (2) probably in unilateral complete destruction of one longitudinal bundle with the fibers of the arc on the same side arising near Deiter's nucleus.

According to **Koellner,** the fundamental laws of labyrinthine action are that each labyrinth tends (1) to move both eyes in opposite directions, the eye on the same side, however, in a higher degree; (2) to rotate both eyes in opposite direction; (3) to direct the eye on the same side upwards, the eye on the opposite side downwards. In cephalic movements these labyrinthine actions cause reflex regulation of the ocular position in space, and do so almost exclusively the less the cerebral cortex exerts its influence. With most animals and with infants, the labyrinth acts as the sole regulator of the position of the eyes. We may assume two different sense organs within the vestibular apparatus; otoliths transmitting sensibility during rest, and semicircular canals reacting to motion.

Different types of labyrinthine disturbances or stimulations incite different types of nystagmus. In suspected tumors of the cerebello-pontine angle, the absence of caloric nystagmus on the affected side has as practical a significance as the appearance of spontaneous nystagmus in diseases of the vestibular nucleus. Labyrinthine disturbances are also supposed to cause many types of strabismus, especially in children, when fusion is still poorly developed.

Certain types of miners' nystagmus probably likewise have a vestibular origin. Since it is not yet proved that in the human subject the persistent cutting out of one labyrinth incites persistent nystagmus, this type has always been assumed as due to some central cause. We are still in doubt in what way ocular movements are affected by other stimuli, the most significant among them apparently being the sensible excitations from the throat.

Sears states that he does not wish to present anything new, but desires to make a recapitulation of the Bárány ear tests. His article is a plea for their more extended use in small towns and sections remote from the greater medical centers.

Kestenbaum speaks of latent nystagmus and fixation. In solving his problem the author seeks to answer two distinct questions: (1) The cause of the manifestation of nystagmus. (2) The mechanism of the nystagmus. From these investigations he concludes that from each of the two foveae, directly an acute image presents itself especially where objects of attention are concerned, issues an impulse to simultaneous and opposite fixation. If the median plane cross impulses fail or are not strong enough, latent nystagmus is manifest.

Just as pathologic vestibular nystagmus is a result of partial disturbance of a physiologically necessary reflex of the suspensory apparatus, so also, latent nystagmus is caused by a partial disturbance of a physiologically necessary reflex, i. e., fixation, in this way, that of the 4 reflexes from the foveae, the two on the median plane are the least developed. The disorders of the fixation reflexes in latent nystagmus are believed by the author to be congenital in character.

Ball reports a case of voluntary unilateral nystagmus. So far as the writer knows, only one like case (Pyle: Jour. Am. Med. Assn., Dec. 5, 1908) has been recorded.

J. L., male, aged 21 years, consulted him on March 15, 1921, complaining of headache over the left eye—a symptom which had been present for six months. He also was troubled with after images.

The globes, adnexae, and pupillary reactions are normal. Stevenson's muscle test shows insufficiency of convergence varying from 1° to 14°. Kagenaar's ophthalmometer shows astigmatism with the rule: 0.75 D. in the right eye; 1 D. in the left. Vision in the right eye 20/20; in left eye, 20/20. At this point in the examination the patient mentioned his ability to produce nystagmus at will, and at once gave a demonstrations as follows:

Seated at one meter, fixing with his right eye, Mr. L., at will, could move his left eye inward and outward for about 2 millimeters from the vertical line. Meanwhile the right eye remained immobile.

Under cycloplegia (atropin) vision was: R.E. 20/50; L.E. 20/40. R.E. with + .50 sphere + .50 cylinder axis 90°=20/13. L.E. with + .75 cylinder axis 90°=20/13. A Wassermann test was negative.

From his observations, **Apel** concludes that *hereditary nystagmus* may be considered as the result of a defect in the vestibular apparatus, and that, as so far there has been no clinical differentiation possible between central and peripheral disturbances of this kind, the cases of Friedreich's ataxia, myoclonia and Wilson's disease must also leave doubt as to whether the germ plasma of the peripheral or central apparatus is to blame.

Ohm concludes that nystagmus is caused by exhaustion of the levator muscle of the lid. Stellwag asserts that nystagmus and head nodding are both symptoms due to the same central disturbance. The present theory is that nystagmus and head nodding are the result of labyrinthine irritation.

Experimental Nystagmus. — **Baurmann**, at the suggestion of von Szily, studied the compensatory ocular movements of amphibia and selected for his experiments the larvae of frogs. Two types of ocular movements were distinguished: (1) those elicited by rotations on a horizontal disc, and (2) those elicited by changes of position with regard to gravity. Destruction of one labyrinth causes a vertical bilateral deviation toward the side of operation, which disappears spontaneously after two weeks.

Bartels criticises the speculations of Ohm. He considers it impossible to compare, on account of formal similarity, 2 curves, of which the one of the tuning fork rests on known physical conditions and exact mathematical calculations, while the other refers to a perfectly unknown number of many nervous stimulations and changes of a living substance, which are hard to investigate and of which we have no physical conception.

For elucidating the question as to the origin of the phases of oscillation, Bartels shows the curves of a recording isolated ocular muscle changed by the minimal disposible irritations of the labyrinths by turning of the head, which excitation causes the changes, and on which paths its innervation takes place is still unknown. Only careful experiments may solve the problems, not the "play of phantasy," as Ohm designates his own exposition.

Buys has studied rotational nystagmus. His purpose was to investigate the relation between the uniform angular acceleration and the ocular reaction, in man. He utilized acceleration for the principle of rotation, in preference to the retardation or to negative acceleration, or to modifications of velocity which can be brought about in the course of the rotation itself; since all these are susceptible of disturbances at any distance from the initial acceleration. He made use of a seat which turned on a sphere, of light construction, provided with a pulley on the axis. A cord turning upon the pulley passed over a second pulley independent of the seat, and disposed in a vertical plane; at its free extremity weights were attached, intended to put the seat in motion. A special apparatus fixed to the seat gave the angular measurement of 18° in 18°; the nystagmograph recorded the nystagmus; the time was noted in 1/15″.

Conclusions: The intensity and the duration of rotational nystagmus are regulated by the intensity of the acceleration stimulus, and by a peculiar factor which results from the succession of contradictory stimuli. This second factor is, above all, a modifier of the duration, while the intensity of the stimulus acts almost exclusively on the intensity of the reflex. The result is that the elements of intensity and duration do not necessarily accord with one another and that there is nystagmus of weak and of long duration, as well as of acute and short duration.

de Kleijn and **Dusser de Barenne** report vestibular ocular reflexes in a rabbit. After ablation of half the brain of the rabbit, nystagmus followed upon rotation, but syringing both ears produced no ocular movements. The procedure causes no difference in the excitability of the two vestibular systems (Bauer and Leidler's theory). The same nystagmus may be observed following rotation after the labyrinth of the same side has been extirpated, in addition to half the brain.

de Kleijn and **Versteegh** experimented on dogs. Nystagmus in darkness in the young dog does not originate in the labyrinth, because existing nystagmus in darkness continues after bilateral extirpation of the labyrinth, and because nystagmus in darkness may be developed upon bilateral extirpation of the labyrinth. Under certain conditions it is possible in existing nystagmus in darkness to incite a combination of both types of nystagmus—caloric and in darkness—at the start and at fading away of a strong vestibular excitation. These same phenomena were observed and recorded in human subjects with spontaneous nystagmus (latent and amblyopic nystagmus), where syringing one ear with cold water produced a definite combination of existing and caloric nystagmus.

Mazzei sums up previous methods devised for recording nystagmus, both on the human eye and on experimental animals. In the author's own method, the extrinsic muscles are isolated and the recti cut off from their scleral insertions, leaving intact only the muscle or group of muscles to be tested. The muscle is connected by a thread to a lever bearing an indicator and the shadow made by this indicator is photographed on a revolving drum. Where it is desired to investigate antagonistic muscles, two levers and two drums are used. The nystagmus is produced by irrigating the external auditory canal with cold water. Twenty-six experiments are recorded. Where only one muscle was cut, the nystagmus produced by the remaining muscles is seen to be limited in the field of the cut muscle. Cutting of all the muscles except one gives a record of the movements of that muscle. Where all the muscles except the internal and external rectus were cut, the tracing of one shows the rapid phase of nystagmus and that of the other the slow phase. By this method, the author expects to be able to study nystagmus in its different forms and its particular manifestations.

Ohm refers to the law of the displacement of the phase, for the analysis of tones, composed of notes and overtones. Ohm takes the first overtone having per second exactly double the vibrations of the note. In combining two such curves of the same amplitude while displacing the phases of both tones, he obtains curves of irregular height at various interspaces. In comparing them to the curves in nystagmus, simple pendular as well as compound pendular nystagmus may be differentiated; the former is comparable to the notes, the latter to the overtones. Most cases of miners' nystagmus are of the simple pendular type, tho both types occur. Ohm also believes that he can thus prove the vestibular origin of the rapid phase of jerky nystagmus.

Struychen formerly attached a metallic ball to the cornea by 3 sharp needles. Now he uses a little rubber suction plate, in photographing movements of the eye in nystagmus.

Vail studied, by the Bárány rotation and caloric tests, tumors of the nervus acusticus. He reports investigations upon 10 cases of unilateral tumors of the acoustic nerve. He found, among other symptoms, spontaneous nystagmus of different forms and directions. A unilateral abducens paralysis can cause a difference in the spontaneous nystagmus of both eyes, but has no effect on that caused by irritation.

Brabant reported experiments made in the laboratory of Psycho-Physiology of Belgian Aeronautics, and representing an attempt at finding out (by a turning chair, permitting detection of direction of the nystagmus of the subject during rotation): (a) Whether the principal phenomena observed during and after rotation are to be attributed or not to rotation; whether they correspond or not to the "physical laws" directing the movements of an endolymph which would change place according to the movements of the body; (b) Whether these phenomena of rotation are peculiar to the sense of equilibrium, which concerns its function of recognition of angular displacement; or whether they are common to other modes of application of the sense of equilibrium.

Nystagmus (which is the manifestation most easily detected and measured objectively) is studied: (a) in respect to classic rotation and its experimental modifications; (b) in different modes not considering the possibility of endolymph displacements. Nystagmus provoked by rotation and angular displacements is not the exclusive effect of a displacement of the endolymph. Rotation does not stimulate directly the labyrinth. The nystagmus is characterized, first, by effort, which is the determining cause; secondly, by the fact that its axis is not represented by the tonic but by the dynamic position of the eyes. The rapid movement representing the voluntary reaction is directed towards the fixation point.

Nystagmus, and the sensations and reactions pertaining to the phenomenon of equilibrium, are connected with the muscular equilibrium of the eyeballs, which may be altered or not, according to variable and occasional causes. The extrinsic muscles of the eyeball are the principal peripheric organs of the sense of equilibrium. The membranous labyrinth, contrary to the current conception, does not represent the peripheric organ of the sense of equilibrium.

De Kleijn has studied tonic reflexes from the labyrinth and throat to the eyes. Tonic reflexes from the labyrinth to the eyes (in the rabbit: rotation and vertical deviations) have repeatedly been investigated at the Utrecht Pharmacologic Institute; yet the tonic reflexes from the throat to the ocular muscles have not been closely analyzed since Bárány first described them. Tonic reflexes from the labyrinth are independent of the absolute position of the head in space, and induce the eyes to retain their position in space. Tonic reflexes from the throat to the eyes depend on the relative position of the head to the body. If the relative position of the head to the body be changed when the body is in a fixed position, not only the reflexes from the throat, but also the reflexes from the labyrinth to the eyes, are changed, since the position of the head is changed in space.

MINERS' NYSTAGMUS.—**Barton** has made an examination of pit ponies with special reference to miners' nystagmus. The author decided to see if animals employed under the same conditions as the men also had nystagmus. For this purpose he selected pit ponies, who haul the coal around in the pits. It was first estimated that the ponies spend as much time in the pit as the men. It was found, however, that the ponies do not get nystagmus. The author thinks that the reason for this is that the pony has not a central fixation of a very highly specialized order, while the miner has.

Romiee finds that defective illumination in the mine is the principal cause of nystagmus. With better lighting it has been diminished, and since the introduction of the eight-hour day has almost entirely disappeared.

Bielschowsky considers the origin of nystagmus of miners. Dransart's theory is that accidents and general diseases call forth "latent" nystagmus. Most of the French and Belgian authorities agree with him. Romiee states that accidents rather tend to lessen nystagmus, from the enforced rest they necessitate. Llewellyn denies this, and states that nystagmus is made more marked in these cases, as the control necessary while at work is relaxed and the nystagmus increased.

The darkness of the mines and the bent position of the head are both causes of nystagmus, tho just how they affect the system is not known. Ohm traces the cause to irritation of the labyrinth. The ocular muscles are directed from cortical and subcortical nerve force. The cortical supplies the associated bilateral equal vision, the subcortical is responsible for dissociated unilateral vision and nystagmus.

Harford calls miners' nystagmus a "visual neurosis." **Martin** believes miners' nystagmus is a functional disease of the nervous system and is due to exhaustion. First the visual centers, and then the higher centers become worn out by constant effort. The victim has a haunted look, is nervous and depressed. There is loss of self-confidence, a fine, general tremor and alteration of reflexes. In bad cases, the accommodation reflex is sluggish. He suffers from headaches, giddiness, and, at times, fear of the dark.

Ohm reports a case of strabismus in marked deviation in an upward direction. No pronounced strabismus when the eye is raised, when lowered there is median strabismus in an inward direction. In turning horizontally to the right, the left eye rotates markedly in an upward and inward direction; in turning to the left the right eye behaves similarly. If the right eye turns in the lower right direction, the left eye is directed horizontally to the right.

Anderson presented a resolution that the home office should be urged to fix a standard refraction test for coal miners, with the object of diminishing the incidence of miners' nystagmus. It was possible, he said, to detect the primary symptoms of the disease in nearly twenty-five per cent of the men engaged in the coal mines.

PUPILLARY NYSTAGMUS. — **Dimitz** and **Schilder** report two cases, one of *lethargic encephalitis,* one week before death, showed ptosis, anisocoria, slow reaction of the dilated left pupil, deviation of the left eye up and out. Five days later, slow nystagmus on looking to the left. Normal pupillary reaction, incomplete ptosis, and both eyes limited in abduction. The eyeballs showed rhythmic convergence movements and inward rotation, accompanied by synchronous pupillary contractions. The movements were nystagmic, having a slow and a quick component, the pupils showing a difference of about 2 mm.

In another case, following an eclamptic attack, there remained a bilateral paresis. On looking upwards, vertical nystagmus; towards the right, horizontal nystagmus of the right eye with vertical nystagmus of the left. Downwards, horizontal nystagmus of the right eye towards the right. Right hemiparesis. The latter gradually improved. Five months later, spontaneous nystagmus upwards, the left eye with a rolling component outward. Looking to the left, rotatory nystagmus of the right eye towards the right. The left eye lags behind on looking to the left. The left eye showed nystagmic pupillary movements synchronous with the upward nystagmus.

CEREBRAL NYSTAGMUS.—Under this name, **Santos Fernandez** reports the farther progress of a case which he had reported in 1904 as one of hysteric nystagmus. The condition, which had appeared suddenly, persisted after eighteen years, and was now regarded as undoubtedly due to a cerebral lesion distinct from hysteria.

HYSTERIC NYSTAGMUS.—The experience of the war in relation to hysteric disturbances (psychogene störungen) of the external eye musculature has been summed up by **Oloff.**

1. In almost all cases, an accurate test establishes the fact that an underlying anatomic diseased condition of the eye or its vicinity (wound, foreign body, blinding, conjunctivitis, keratitis, strabismus concomitans, latent disturbance of equilibrium, etc.) lies beneath the hysteric condition.

2. In the pathology of hysteric eye muscle disturbances, spasms play the principal role. An exception to this is the relaxed ptosis, which is looked upon as a symptom of paralysis. There are, however, rare cases, according to war observations, in which perhaps an "hysteric" paralysis of the ocular musculature may also occur.

3. The most frequent hysteric disease of the eye musculature in war is blepharospasm, which may occur in degrees of intensity from a hardly visible quivering, to a most pronounced clonic or tonic convulsive state.

4. In very difficult differential diagnosis between a pseudoptosis, caused by spasm and a true ptosis due to paralysis, the "eyebrow sign" of Charcot has been used by some, but this cannot be relied upon completely. The results of suggestive therapy as built by the war are far more decisive.

5. According to the researches of Kehrer, a specific sensitiveness of the sympathetic part of the levator palpebrae superioris plays the principal role in the occurrence of ptosis, and this sensitiveness is by nature highly developed in some people.

6. The researches of Margulies among participants in the war have proved, that contrary to the views of peace times, hysteric paralysis of the ocular facial nerve often takes place. As a concurrent symptom Margulies has maintained the lack of the Bell phenomenon.

7. The character of the innervation of the musculature of the eyeball, as well as the close relations between hysteria and the cerebral cortex, establishes the fact that here as a rule there occur not disturbances of a single muscle but only disturbances of associated movements in the region of innervation; and these occur in war, as in peace, most frequently in the form of convergence and divergence convulsions, often combined with accommodative spasm.

8. The existence of hysteric nystagmus, much doubted before the war, has been definitely established now; but the hysteric nystagmus shows significant differences in form and kind from miners' nystagmus and its related forms.

9. Hysteric disease conditions of the ocular musculature may, in rare cases, occur as a single symptom due to

the great mental and physical exhaustion in war, without other hysteric symptoms, and without a specific psychopathic predisposition, occurring in entirely healthy people purely under the impetus of a catastrophic happening, i. e., a mine explosion, etc.

The hysteric motor disturbances of the eye are divided by **Bielschowsky,** into three groups: (1) spastic symptoms, (2) paralytic symptoms, (3) this group presents anomalies of position and motion that are neither spastic nor paralytic. Of these the first group is most frequently met with, including blepharospasm, convergence spasm, conjugate deviation, and hysteric nystagmus.

The paralytic symptoms due to hysteria are more difficult to diagnose. Among them are diplopia, convergence paralysis, divergence paralysis and ptosis. The author considers under group three that dissociation of ocular movements and paralysis of ocular muscles can not be considered as hysteric symptoms. The functional motor disturbances belong to those whose chief symptom is the collapse of the fusion mechanism. The psychologic, as well as the functional motor disturbances of the eyes, are dependent on the physiologic laws of ocular movement.

Barnes states that neurasthenic patients often have an irregular activity of the extrinsic muscles. Ophthalmologists sometimes mistake this condition for strabismus or heterophoria. These patients, instead of sending the correct amount of nervous force into the various muscles concerned in a given act and thus producing a normal coordinated action, send into certain muscles an unduly large amount of nervous force, and jerky, incoordinated action result. Acts which ordinarily are performed automatically are consciously performed. The ophthalmologists should endeavor to make the patient feel at ease, and by exercising the various extrinsic muscles and diverting his attention, the spastic condition may pass off. Repeated examinations and the administration of general sedatives should clear up most of these cases. On second examination, a different muscle may be producing a deviation or no deviation may appear.

Book Reviews.—**Worth.** Squint; its cause, pathology and treatment. Previous editions of this work have doubtless been read by most ophthalmologists. The amendments and new subject matter included in this last edition render its possession valuable.

Landolt. Defective Ocular Movements and Their Diagnosis: This book has been published for some years, but it should be better known to English reading ophthalmologists. As the authors state in their preface: "We have not attempted to write a hand book but merely a handy book, a guide to aid the student and practitioner in finding his way over the oculomotor system. a path on which it is so easy to go astray."

Wilbrand and **Saenger** in the eighth volume of the Neurology of the Eye present much valuable work and experience. Its "general" part of 394 pages, discusses motor tracts and centers, ocular movements and the paralysis of ocular muscles in the order of the localization of the disease, that is, from cortical to orbital or rather myogenous paralysis. A chapter on "purely functional nervous" paralysis is added.

The chapter on "spasms of ocular muscles" chiefly deals with the various types of nystagmus and their etiologic bases, and presents the subject clearly and exhaustively. The "special" part of 28 pages is evidently planned to serve as a synopsis of the information contained in the "general" part, but is not exhaustive and brings some repetition. On the whole the volume is, however, a valuable resource in scientific research.

The Conjunctiva

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This section reviews the literature relating to the conjunctiva and its diseases appearing during 1921. For previous references to the subject see OPHTHALMIC LITERATURE, 1921, v. 17, p. 71.

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DIGEST OF THE LITERATURE.

ADENOID TISSUE OF CONJUNCTIVAL CULDESAC AND LYMPHOMA.—**Kalt** states that anatomists have described in the conjunctiva of the culdesac, beneath the epithelium, a reticular formation infiltrated with leucocytes. The question is whether this is normal or whether it represents conjunctiva modified by the invasion of lymphocytes for defensive purpose. He has observed a man 60 years of age, apparently in good health, having a tumor forming in the superior culdesac of the right eye. It was pinkish and had the form and size of a date stone. Other structures were normal. It had no connection with surrounding structures. Histologically it was a lymphoma. Later a similar growth appeared in the same locality of the other eye. Examination of the blood showed a lymphocytosis with mononuclear excess and an excess of red cells. He concludes that there was a local determination of a general condition as revealed by the blood.

CONJUNCTIVAL VESSELS.—**Zeller** describes an apparatus with which he measured the velocity of the blood current in the conjunctival vessels of the living eye, under the binocular corneal microscope. As the current of the blood fluid cannot be directly perceived, the movement of the central portion carrying the colored blood cells was utilized for the measurements. He found for arteries of from 0.01 to 0.03 mm. diameter an average of from 1.6 to 3.5 mm. per second, for the veins from 0.7 to 1 mm. per second. In older persons the movement is slower than in the young. He could not ascertain a constant relation between the velocity of the current and the vascular diameter.

Zeller then studied the changes in the conjunctival vessels and the capillaries of the sclerocorneal junction in arteriosclerosis, lues, and diabetes. In arteriosclerosis an increase of the physiologic curvatures with intense meandering was observed; in syphilis, multiple fusiform and sacciform dilatations, especially of the smallest veins and capillary loops; in diabetes, ectasia of the capillaries. These alterations are very interesting and partly characteristic, but Zeller warns against their exclusive value for the diagnosis.

Finally, Zeller investigated the influence of adrenalin, atropin, pilocarpin, physostigmin and cocain on the conjunctival vessels and the velocity of the blood current in them.

HISTOLOGIC STUDY OF LIVING STAINED CONJUNCTIVA.—**Knuesel** and **Vonwyler** employed a 1% solution of neutral red to stain the living cells of the conjunctiva. It was applied locally. The histologic result was an intensive, deep red, vital granule staining of the corneal and conjunctival epithelium. By immersion, the curetted teased epithelial cells showed in every cell a red granular sphere attached to the nucleus, or a nuclear ring thickened on one side. The nucleus and outer plasma did not stain.

ANOMALY OF VEINS.—**Kraupa** not so very rarely observed for years at the temporal lid angle of younger and older people, in the shape of a triangle, a prominent vein in the subconjunctival tissue, which emerged typically from the temporal palpebral ligament and again submerged into it. The vein was 3 times wider than the other episcleral vessels. Its shape always was approximately the same, but its spreading towards the limbus on the surface of the eyeball changed. The eyes were otherwise perfectly normal, so that the venous loop must be considered as a congenital anomaly. If one is familiar with its occurrence, one will not, as the author did in his first case, confuse it with dilated episcleral veins encountered in sarcoma of the choroid. **Knappstein** discusses formation of the conjunctival sacs.

BACTERIOLOGY.—In a total of 1,004 consecutive cases of conjunctivitis, organisms were found by **Pa** 497 times, including 40 cases counted more than once on account of mixed infections. Morax-Axenfeld bacillus, 166 times, 33.4%, staphylococcus 97 times or 19.3%; pneumococcus 95 times or 19%; Koch-Weeks 66 times or 13%; xerosis 29 times or 6%, streptococcus 6 times or 1.4% and gonococcus 8 times or 1.8%.

Bornemann describes his experiments on the bactericidal action of noviform salve, which within the last four years has been used with great satisfaction at the eye clinic in the University of Leipzig, for sterilization of the conjunctival sac before operations. After one or two applications, it renders the conjunctiva clinically sterile in quite a number of cases.

Gama does not think it possible at this time to classify conjunctivitis according to the germ producing them for the following reasons: The pathogenic agent causing some of them is not yet known, and treatment by serotherapy in those in which the germ is known has not yet been put into practice. In many cases there is a microbic symbiosis, a single germ not being the only factor. He proposes a retention of the classification into purulent and nonpurulent.

TOPOGRAPHY OF CONJUNCTIVAL INFECTIOUS TOXINS.—**Lindner** finds that all germs causing infective inflammations of the conjunctiva attack directly the epithelial cells, and he has identified infectious inflammations of the conjunctiva as epitheliosis. The number of bacteria present in the secretion, at least in the beginning of the disease, is very small, when compared with the great number found growing on or in the epithelial cells. The steps of infection are: First the germ or germs are localized at a place on the normal epithelial layer which is closed. There they may multiply, forming a pavement adhering to the epithelial layer. From this point they spread over the ocular conjunctiva as a result of the movement of the lids, forming new foci of infection.

From the first group, toxins are produced which enter into the tissue by diffusion. This produces the evidences of inflammation. The toxins produce a proliferation of the epithelial cells, which with the help of the edema opens to them the layer that before this was closed and allows the germs to grow into the epithelial sheaths. The germs remain fastened to the cells where they continue to multiply. In infectious conjunctivitis, the bacteria confine themselves to the epithelium. The gonococcus at times enters the subepithelial tissue. Most organisms show a strong predilection for the bulbar conjunctiva, at least in the beginning. In diphtheria the affected cells show marked signs of degeneration. Based on the topography of the inclusion and free initial bodies, trachoma may be classed as a bacterial infection.

Taking the gonococcus as a type, the progress is for the germ to grow abundantly during the first few days, from the large pavement cells down to the subepithelial tissue. At the beginning of the second week, the germs are fewer in number and no longer extend into the deeper layers, and some of the bacteria are phagocyted by the epithelial cells. In the third week the thickened epithelial layer is practically free of germs. In the Koch-Weeks conjunctivitis, phagocytosis by the epithelial cells begins early. In Morax-Axenfeld conjunctivitis, pavements are found only in the transitional epithelium, near the skin margin. In the later stages of all infectious conjunctivitis, the number of germs is quite small and appears to bear no relation to the continuance of the disease.

In a second article Lindner states that all infectious organisms are found first in the epithelium of the conjunctiva. Taking the gonococcus as a type the initial organism is found upon the normal epithelial covering of the conjunctiva, and there they increase. From this local position they spread to other parts of the membrane by the movements of the lid. Both in the beginning and later, the gonococcus has a focal character. In the second stage the epithelial layer is elevated and exfoliated, but the organisms are still on the surface. The explanation of this change is that the toxin generated by the coccus diffuses itself into the epithelium and into the underlying tissue where it excites the phenomena of inflammation, especially edema. The fluid finds its way into the cell and spaces develop. Added to this is a marked proliferation of the epithelium.

In this way the union of the epithelial cells is dissolved, and the virus finds its way practically unhindered into the deeper tissues. The gonococcus attacks by preference the bulbar conjunctiva. There is an almost entire absence of phagocytosis. The K-W bacillus infection corresponds in all important points to the gonococcus. The diphtheritic bacillus is a typical epithelial parasite. The M-A bacillus is found neither in the epithelium of the bulbar or palpebral conjunctiva, but where the conjunctiva goes over into the skin of the lid, and in the whitish discolored epidermis the organisms are found. He states that the blennorrhea of the new born is either an inclusion blennorrhea or a gonococcal blennorrhea. A third type of blennorrhea has no existence.

Lindner continued his investigation of the topography of pathogenic bacteria in the conjunctiva. The gonococcus, pneumococcus and Koch-Weeks bacillus invade the epithelial cells of the conjunctiva 2 or 3 days after the onset of the disease. Influenza bacilli are found in the epithelial cells in small numbers but are numerous in the mucous secretion. The diplobacillus does not invade deeply into the epithelium, but is found around cornified and dead epithelial cells. The author claims that trachoma occurs in an acute form in some cases, and is difficult to differentiate clinically from gonoblennorrhea. Trachoma however, does not develop so rapidly. From the cases which he has examined, Lindner is convinced that the diphtheria bacillus is an epithelial parasite.

CONJUNCTIVAL DISCHARGE.—In over 300 experiments **Morandi** proved, that in the conjunctival exudate of spontaneous conjunctivitis there is never more than 2% of *eosinophiles,* except in vernal catarrh, pemphigus, sporotrichosis and hay fever. Any larger percentage than this is a sure sign of simulation. Two cases are reported of *provoked conjunctivitis* from the use of castor oil seeds. In one of them 47% of eosinophiles was found. Seven percent in the other. On the fourth day, when the condition was clearing up, a small whitish seed was found under the upper lid, while the conjunctiva was red as at the beginning; and the patient was evasive. Eosinophiles had increased to 21%. The condition was cured by the use of yellow oxid of mercury after ten days. The author considers cytologic examination of conjunctival exudates of great value in the diagnosis of induced conjunctivitis.

OPHTHALMIA NEONATORUM.—An editorial in the *British Journal of Ophthalmology* calls attention to the fact that the methods employed for getting immediate and adequate treatment for ophthalmia neonatorum are still very unsatisfactory, and it expresses the hope that the Committee sitting on the "Prevention of Blindness" which is dealing with this subject inter alia and is somewhat overdue, will make stringent recommendations to procure immediate treatment of the disease and also for the education of students and midwives in its natural history, as was recommended in a resolution passed by the Ophthalmological Society in 1920. An editorial in the *Lancet* suggests, that a special form should be issued, to be filled in for each case of ophthalmia neonatorum, in order that we may know what damage is done by the disease and to what extent the knowledge of it is best to be utilized or ignored. By the adoption of this plan, attention would then be focussed on the cases of ophthalmia neonatorum. Harman says prevention of this disease can be secured by the treatment of the vaginal disease of the expectant mother; this is the one and only certain means of prevention, and it is within our power to accomplish this desirable end. As to the treatment he says that what is now needed is the establishment of such arrangements, that diagnosis and treatment can be made as swiftly as the fire brigade can be brought in when there is an outbreak of fire in our homes. In an editorial comment the *Lancet* says that it is no easy matter, however, to get hold of the expectant mother. It may become easier as the work of the antenatal clinics grows. There is frequent failure to secure skilled treatment at once. The birth attendant may not be able to make note of the danger signal, or the needs for a "fire brigade." To some extent the schools and hospitals are at fault.

Cantonnet found but 18.5% of gonococcal conjunctivitis, in 42 cases of purulent conjunctivitis in the newborn. In 12.5% only the ordinary microorganisms were found. Altho inclusions were found in epithelial cells, these were encapsulated and similar ones were found in the mother's vagina and in the male urethra. It does not differ materially from that caused by gonococcus except that it develops later—not until 12 days. It lasts from 15 to 20 days, exceptionally from six to eight weeks. Nitrat of silver has no prophylactic value.

Dundas has seen a case of prenatal ophthalmia neonatorum. Five minutes after birth the baby was found to have red and edematous lids. The liquor amnii dribbled away two weeks before labor. The child died cyanotic on the tenth day. Postmortem, a purulent exudate in the middle of the base of the skull, from the optic commissure backwards, was found. There was fluid blood in the sinus. The mother had a creamy discharge before the birth of the child.

Land noted an increase in cases of conjunctivitis of the newborn and *mastitis* in the lying in was not frequent. A relation between the two was not found. An infection of the nursing breast by pus from the catarrhal conjunctivitis is possible but rarely demonstrable. These rare cases do not prove the eye pus to be an important factor in the mastitis, but prophylaxis to protect the breast should be taken.

Grafe advises that the surgeon himself should flush the eye every 12 hours with a 1:300 solution of cyanid of mercury, besides using mild lotions.

Hirsch gives a statistical report on the morbidity of ophthalmia neonatorum in Bavaria before and after compulsory reporting and prophylactic treatment. The periods covered are from 1893 to 1907, and from 1912 to 1919. In the first periods before the law was passed the incidence was 5%. In the second period after the law was passed it was 0.7%. The author believes both acts of the law played a part in the results. Prophylaxis limits the morbidity of the disease to a minimum, and the necessity of reporting cases increases the care of the midwives and prevents further development in already existing cases.

Buchacker gives the percentage of ophthalmia neonatorum occuring in a Mainz service during the years 1913 and 1920. In the first four years the percent was less than 9.3 except in 1914, and then it was 0.83%. In the next 4 years, it ranged from 1.8% to 4.6% despite the thoro employment of the Crédé method. He concludes the cases of eye inflammation of the newborn have greatly increased since 1917. The increase is with the increase of gonococcal diseases. This may be due to an increase in the virulence of the gonococci, or a resistance to silver preparations. The instillation of a 1% solution of silver nitrat did not prevent the occurrence of blennorrhea, but simply caused a delay.

Dupuy-Dutemps treated two cases of gonorrheal conjunctivitis in young girls solely by serotherapy. In both, there was ulceration involving almost the whole extent of the cornea. After the injection of the anti-gonococcus serum, there was a marked local and general reaction, but the conjunctival secretion cleared up rapidly, and perforation was avoided. The cornea healed quickly.

Kleckowski reports his results in treating gonorrheal conjunctivitis with mixed anilin dyes. His results were good in adult cases. The solution which he used was a mixture of brilliant green 1/5,000, iodin green 1/400, malachite green 1/660, gentian violet 1/200, Hoffman violet 1/200, methylen violet 1/200 and methylen blue 1/100. In the beginning of the disease, the instillations are made every hour after irrigating the eye with normal salt solution.

The *Lancet* comments that ophthalmia neonatorum can be prevented, and cases of it should become exceedingly rare. For this reason, every lying-in hospital should have an ophthalmologist on its staff, so that nurses and obstetrician may have adequate instruction in the method necessary to prevent the disease.

Koltonski discusses the various methods in use for preventing ophthalmia neonatorum, and concludes that choleval in a 1% solution, is an effective prophylactic against the disease.

MacCallan has noticed that there is considerable difference between gonorrheal conjunctivitis in Egypt and Europe. In most cases in Egypt, the infection is acquired from the conjunctival secretions of another person, while in Europe it is usually of venereal origin. The Egyptian variety is not so virulent, and frequently occurs in a subacute and chronic form. The disease is more prevalent in the Spring time. When treated, the disease is not as destructive as in the European variety. Probably seventy per cent of the blindness in Egypt is due to untreated gonorrheal conjunctivitis, but treated cases rarely develop complications. **Beaton** assisted MacCallan in studying the morphologic characteristics of the organism, and found that they were the same as the gonococcus.

McCleary refers to the nature and frequency of ophthalmia in Egypt.

Van der Valk writes that the differences between the parakeratotic papule of gonorrhea and the erosive lesions which occur under the prepuce and in the eye are probably due solely to their great differences in moisture and protection. After reviewing the literature concerning the mode of origin of these lesions, the author concludes that, instead of being blood borne, it is quite possible that the causative agent, be it organism or toxin, may follow the nerve fibrils. The corneal distribution of the condition in his two cases suggested this. **Lindner** has written on the blennorrhea of the newborn.

GONOCOCCAL OPHTHALMIA OF THE ADULT.—**Heinemann** and **Wilke** speak of the difficulties that beset the prophylaxis and treatment of gonococcal ophthalmia in primitive people. (East Coast Sumatra). They employed ***protein therapy,*** using milk and also casein. In eleven cases so treated no complications arose. After the first injection inflammatory symptoms rapidly subsided. The course of the disease was reduced from six weeks to three weeks. They consider casein an ideal preparation. **Lindner** reports on an epidemic of 56 cases of gonoblennorrhea occuring among soldiers sent to Luhlin for treatment. Forty-eight were bilateral. In his research for the origin of the infection, Lindner found on the fourth day that a student of pharmacy of the first year, acting as a substitute for the reserve surgeon, had inspected the reporting eye patients daily, by everting the lids of each and instilling 10% protargol without washing his hands. Thus this patient who had infected his eye from his gonorrhea was the originator of this terrible epidemic. By careful treatment, successful results were obtained. In only two cases ulceration of the cornea occurred, and in one a perforation, altho ten patients were over forty and four over fifty years of age. The majority were in the twenties. The epidemic was not mild.

Stanford reports the occurrence of bilateral gonococcal conjunctivitis in a boy three years of age. The left cornea showed an ulcer. After flushing with boric acid and *mercurochrome*—220 in 2% strength and the daily application of a 1% nitrat solution, a cure resulted without increase in the corneal ulceration. **Livingstone** has used *colloidal manganese* in three cases of gonococcal ophthalmia. The first was not of great severity, but the action of the remedy appeared satisfactory. In the second case it was not given until the ulcer occured, but the ulcer healed and the discharge abated during its use. The third case was of a virulent type, in a man 24 years of age. The day before admission the disease was well advanced. Beside warm compresses and argyrol, two doses of 1 c.c. of colloidal manganese were given intravenously at two day intervals. The improvement was marked. The third injection was given four days later. At the end of 16 days the conjunctiva was almost normal.

Pillat believes that the *milk injections* in gonococcal conjunctivitis may act in the following ways: Increased damage to the gonococcus. A profuse production of pus may carry away the germs. Especially rapid exfoliation of the superficial epithelial cells to the attached gonococci give place to new formed epithelial cells, capable of resisting the gonococcus. The marked hyperemia of the blood vessel symptoms (far greater than that produced by the gonococcus) brings to the parts fresh lymph to carry off the toxins of the gonococci, and to cause the rapid disappearance of the edema of the lids and eyeball. Fever increases the destruction of albumin in the body. The resorption of the byproducts of the albumin may lead to the formation of proteolytic ferments which act upon the blood vessels of the eye.

Cecchetto reports 59 cases of gonococcal conjunctivitis treated with antigonoccic *vaccines*. The best results were secured with Nicolle and Blaizot's vaccine. In five instances there were corneal ulcers, of which four developed before the treatment was begun. One to seven injections were sufficient, but in a few cases ten to twenty were required. **Constantinesco** reports on the treatment of twenty-three cases of gonococcal conjunctivitis treated with Sterian's serum. His experience was that the duration was greatly reduced and the onset of the ulceration of the cornea was prevented, if the serum was used before this complication had occurred. The testimony of **Dupuy-Dutemps** was to the same effect.

Luithlen does not believe that the use of the concentrated sodium or calcium had any advantage over vaccines. (See v. 17, p. 76.) Their action he believes to be based upon three components. First, foreign albumin; second, as increasing the bodily temperature, and third, specific bacterial action. **Dor** employs parenteral milk injections combined with the local use of a hypertonic solution of sulphat of magnesia, 20:100. He claims excellent results. **D'Ombrain** wrote on purulent conjunctivitis.

Pneumococcus Conjunctivitis. — **Seefelder** describes an epidemic of pneumococcus conjunctivitis. From a study of the condition he concludes in part, that pneumococcus conjunctivitis may be described as a benign affection Still severe complications were not prevented. With optochin a complete recovery was not obtained, and it was not possible to obtain a sterile sac, notwithstanding that Lindner has found that the pneumococcus is present but specifically in the beginning. The resistance to chemical remedies rests upon other biologic qualities of the virus, so that notwithstanding every precaution the disease spreads. The protracted course of the disease, despite all treatment, was noteworthy. **Holff** wrote on epidemic pneumococcus conjunctivitis.

Belgeri's patient was a young child. The lesion was on the palpebral conjunctiva and extended to the bulbar portion and also to the cornea. A white membrane formed which could easily be detached, but rapidly reformed. The organism found was pneumococcus. Antidiphtheritic injections were given.

CHRONIC BLEPHARO-CONJUNCTIVITIS. **Gifford** describes five groups of cases in which the meibomian glands are involved in various affections of the lids and conjunctiva. (1) Simple hypersecretion. These cases are usually seen incidentally with the occurrence of some other condition. (2) Simple inflammation or simple chronic meibomitis. (3) Chronic meibomitis with hypertrophy. (4) Chronic meibomitis with chalazia. (5) Chronic meibomitis secondary. (6) Chronic meibomitis, with concretions.

"Frothy" conjunctivitis is characterized by lacrimation, smarting, fatigue of the eyes, a whitish froth at the external angle of the lids; the glands are very prominent and secrete a yellowish substance. Treatment according to **Coppez**, consists of expression of the glands and application of an alkaline lotion. **Kraemer** has written on blepharo-conjunctivitis.

Munoz Urra reported an unusual case of conjunctivitis in a man who had a markedly swollen lower right eyelid, and who complained of severe pain. On everting the lid, an infiltrated condition of the subconjunctival tissue was seen. This was incised, and the discharge examined. Numerous organisms resembling trypanosoma, were found in the smear. The author concluded that the organisms belonged to the group of leptomonas muscae (Brumpt and Guiart.). This organism is frequently found in the intestinal tract of domestic animals, but is rarely found in the conjunctiva of man. The author was unable to explain the method of infection, but suggests the possibility of an insect acting as an intermediary host.

KOCH-WEEKS CONJUNCTIVITIS IN PALESTINE.—**Feigenbaum** examined the secretions from 371 cases of conjunctivitis, excluding gonorrheal and pneumococcus cases, and found K-W bacillus present in 288, Morax-Axenfeld in 19 and negative findings in 64. Not considering the small elevation of the limbal conjunctiva so frequently met with in K-W conjunctivitis, there was a corneal infiltrate in 68%, superficial ulcers in 6%, hypopyon ulcer in 3.6%. perforating in 2.4%. In ten cases of the last two groups, seven were in trachomatous patients, and in five of these K-W bacilli were present. The author considers this evidence that the association of K-W with trachoma is injurious to the cornea. Two causes for this are poorly nourished cornea and the shape of the lids.

KOCH-WEEKS AND PFEIFFER BACILLUS.—Based upon the microscopic relations, the difference in culture growth on agar as well as the epidemiology of the two conditions, **Pesch** believes that these two organisms must be considered as different. He states that the K-W is a slender rod, only slightly shorter than the tubercle bacillus, mostly extracellular, tho leucocytes are observed with dense masses of the organisms. In genuine influenza conjunctivitis, Pesch found almost punctiform cocci bacteria, irregular, mostly extracellular, in swarm like masses. During an epidemic of influenza in Cologne, the K-W was not observed, whereas since then, there have been many cases, but no influenza. The Pfeiffer bacillus gains access to the eye during an attack of influenza, yet it is seldom found. K-W is easily transmitted. An epidemic of K-W conjunctivitis at Freiburg is reported by **Wiedersheim.**

BATH CONJUNCTIVITIS.—**Comberg** describe this as a unilateral, but ofttimes bilateral quite phlyctenular conjunctivitis. During the acute stage it closely resembles trachoma. It begins in the lower culdesac and lid. In about one week's time the upper lid becomes affected, and the germs localized in the portion in the vicinity of the upper border of the tarus and retrotarsal fold. In severe cases the lids are decidedly swollen and proptosed. The auricular glands are at times affected, and there may be nasal catarrh with occlusion of the tubes. The conjunctival inflammation may continue for months leaving a hypertrophy, but no cicatrices, no pannus, and no corneal complications. The view that it is due to attenuated trachoma virus rests now on no stronger basis than when first advanced. By filtering a portion of the water used in the bath, and treating the water with chlorinated lime, and disinfecting toilets and the doors to them with lysol, the epidemic was stamped out.

Neubner describes an epidemic of bath conjunctivitis occurring in Cologne. The onset of the disease was sudden and reached its climax in a few hours. It was typical that only one eye was primarily infected, and that the condition remained uniocular in a great majority of the cases. The incubation was from 7 to 14 days. The oldest patient was 28 years of age. The inflammation appears first in the lower culdesac and later involves the upper. The follicles are enlarged. Hemorrhages do not occur. Ptosis is present. The course of the disease is eight to fourteen days, but it may persist two or three months. Not rarely marginal keratitis occurs. Smears with methylen and gram were usually negative.

XEROSIS BACILLUS. — **Rumsey** says that while it is stated that the xerosis bacillus is nonpathogenic, this bacillus associated with intestinal disturbance, mostly for the digestion of fats, was apparently the only cause of the conjunctivitis and keratitis in his two cases. The first was one of xerosis of the conjunctiva. In the second case a woman of 64 years of age had had an inflammation of the right eye for five years. An examination of the secretion, made several times by a competent laboratory, showed the presence of a pure culture of the xerosis bacillus. There was intense ciliary and conjunctival congestion. The palpebral conjunctiva was velvety. The cornea lacked luster, and there was a plexus of blood vessels communicating with the conjunctival vessels beneath the epithelium. **Altman** reports a case of xerosis conjunctivitis in a premature baby, artificially fed. At six months a purulent rhinitis accompanied by bloody mucoid secretion from the conjunctiva and a marginal corneal ulcer appeared. Before the nutrition of the child could be improved the ulcer perforated.

VERNAL CONJUNCTIVITIS. — **Junius** has conducted experiments and brought together the literature, seemingly showing that certain changes in the blood, more particularly in the production of porphyrin, together with the photochemic effects of light, cause vernal conjunctivitis. Its cause is either the irritation of the one light or its effect, causing a change in the metabolism of the tissue, or a parasitic influence. The effect of light rays cannot be its sole cause.

The injection experiments of the coloring matter of the blood showed the following: Hèmatoporphyrin has a strong effect in causing intense sensitization of the tissues to the effect of light. Mesoporphyrin, which is in close relation with hematoporphyrin, has little effect. Porphyrinogen causes intensive sensitization. The hitherto unknown constituent, porphyrin, causes intense sensitization and it is thought that porphyrin, with the photodynamic effect of light, plays a role in the production of vernal conjunctivitis. **Langecker** considers that a sensitiveness to porphyrin might be at the base of certain disease such as vernal conjunctivitis. In three cases porphyrin was plentiful in the urine and in two cases only a trace. None was found in the blood in any case.

Pockley reported his further experiences with the cases of vernal catarrh previously described. He had since decided to perform a tarsectomy. He had removed the tarsus and the mucous membrane covering it in one piece, making the incision well above the granulations. The condition recurred at a higher level and the irritation was worse than ever. The operation had been performed after an attempt had been made for a period of five years, with every other form of treatment. **Cords** cured typical pericorneal infiltrations of vernal conjunctivitis in a girl, aged 21 years, which had for two years resisted all treatment, objectively and subjectively completely in a few days, by an intravenous injection of *afenil* 10%. This is a calcium chlorid urea, which contains 11.42% calcium and 68.28% urea, and is manufactured by Knoll and Company in ampules of 10 ccm. The technic is the same as that of injections of neosalvarsan. No disagreeable complications were observed and there was a feeling of heat in general, especially in the mouth, and decrease of blood pressure from 110-113 mm. Hg. to 100-110. Contraindications are affections of the heart and arteriosclerosis.

Clausen employed intravenous injections of 10 ccm. of afenil in a case of vernal conjunctivitis with marked benefit after the first injection. For ten days previous to the injection the weather had been hot and humid, but on the evening of the day the injection was given, turned cool and cloudy. After the second injection there was no improvement. After the third and fourth injections while the subjective symptoms and the lid condition was unchanged, the limbal thickening subsided.

Egtermeyer was unable to confirm the favorable result secured by Cords in the use of afenil in vernal conjunctivitis. In none of the four cases was any improvement noted. In four cases *of hay fever* catarrh in which it was employed, three were either much improved or cured. In either instance an injection of 10 ccm. resulted in a cure.

In **Pichler's** case, treated with afenil, rapid improvement followed its use, but this was but temporary and the further use of it failed to control the symptoms.

Wachtler employed afenil, (chlorcalcium urate) in a case of three years' duration. The conjunctiva of the lids showed the characteristic pavement granulations. Except for a slight injection of the vessels the bulbar portion was uninvolved. Marked improvement in both subjective and objective symptoms followed.

Horner's case was one of the pavement like, flat topped, papilliform elevations of the palpebral conjunctiva, worse on the left side, which had been unsuccessfully treated by lotions. Under radium exosure, 10 mg. gamma radiation disk, screened with 9.5 mm. of silver at 1.2 cm. from the eyes, during four one hour periods, once a week, there was at the end of four treatments a decrease in size and number of papillae and the subjective symptoms were less. A month later there was a gradual return of the conjunctival elevation.

Rossi finds a relation to exist between vernal conjunctivitis and a sympaticotonic condition. **Schrant** describes a type of conjunctivitis which he has seen about a half dozen times. The cases occur and reoccur in spring, summer and fall months. There is a circumcorneal injection. The corneal epithelium for a zone of 2 or 3 mm. is roughened and slightly elevated. The conjunctiva is hyperemic. Subjectively there is itching, photophobia and lacrimation but no other symptoms of hay fever. No organisms were found in the sac.

Gallemaerts reported an atypical case of vernal conjunctivitis in a boy 12 years of age. At the periphery of the cornea, a deeply vascularized zone several mm. in diameter, was noted The cornea had undergone changes which resembled an enormous arcus senilis. In April of each year, intense itching and other symptoms of vernal conjunctivitis invariably made their appearance.

Gonzalez reported a case of vernal conjunctivitis, which was complicated by a conical cornea. The conjunctival plaques were limited to the limbus.

Wolfrum states that the alkalinity of the tears is increased in vernal conjunctivitis. The changes which occur in vernal conjunctivitis resembles those which are produced by scarlet red and its allied products.

Green points out that vernal conjunctivitis may go untreated except for the correction of refraction errors, being regarded as a conjunctival reaction of ametropia. The same is true of conjunctivitis due to food anaphylaxis.

HERPES FOLLOWING APPLICATION OF BLUE STONE.—**Foster** describes a typical case of Parinaud's conjunctivitis in a boy 14 years of age, in the treatment of which blue stone was applied in the hope of reducing the turgescence of the conjunctiva. This application was immediately followed by a rash resembling a fresh attack of herpes over the left side of the forehead, sharply limited by the median line. The skin up to the hair margin was reddened, swollen and presented a considerable number of papule like elevations, but there was neither pain nor hypersensitiveness. This was followed by a dry eczema. Two hours later the rash had disappeared. Three days later a similar application was followed by a similar rash. The author considers it a reflex effect upon the skin supplied by the ophthalmic branch of the fifth nerve. He is at a loss to explain the absence of hypersensibility.

PHLYCTENULAR CONJUNCTIVITIS.—In a recent and typical case of phlyctenular conjunctivitis in a young Arab of 15 years of age, **Blanc,** by combing with a fine tooth comb, secured fifteen lice, which he put immediately in the incubator at 30° centigrade, moist heat. The next day an ape was inoculated in the left eye, with an emulsion of the lice, ground up in 2 ccm. of physiologic salt solution. Their excrements were also added. The inoculation was made by simple contact of the emulsion with the conjunctiva, which was allowed to remain in for a half hour. A microscopic examination of the louse emulsion revealed nothing in particular. A little less than two months after the experiment, the inoculated ape presented in the left eye on the external border of the limbus a characteristic phlyctenule. The phlyctenule was cured in a few days. From this one experiment one cannot draw an absolute conclusion, but it seems to support a relation between phlyctenular conjunctivitis and pediculosis of the scalp.

In cases of obscure phlyctenular keratoconjunctivitis, in which syphilis and tuberculosis have been eliminated, **de Andrade** advises searching for intestinal parasites. The author believes that the oxyuris vermicularis is a common cause.

Marx found the location of phlyctenules at the corneal limbus in scrofulous ophthalmia to be as follows: Right eye superior 19, nasal 31, inferior 46, temporal 48; left eye superior 13, nasal 13, inferior 40, temporal 72. There does not seem to be any satisfactory anatomic or other cause to explain the predilection shown by the above figures.

Veeder and **Hempelmann** studied 196 children with phlyctenular disease, and found a close relationship between the two diseases. Skin tubercular tests were positive in over 93 cases. The results of the complement fixation tests were strikingly similar to those obtained in children of proved tuberculosis. Tuberculous lesions involving other organs than the eye, definitely demonstrable in one-half, seemed probable in almost two-thirds. In children observed over periods of one or more years, four-fifths gave tubercular evidence. **Lawrie** has described phlyctenular disease in the child's eye, and **Harry** has written on phlyctenular ophthalmia in children.

Peltesohn reports his observations on a large number of children with parenteral injections of aolan, an albuminous preparation from milk, in which the disturbing toxic admixtures of the bodies of the bacteria, killed by sterilization, and the specific qualities of the albumin of cow milk are eliminated. The results were moderate in comparison to a large number of failures. Children of good general nutrition suffering from obstinate and severe ocular scrofulosis (blepharospasm and photophobia, deep corneal ulcerations, pannus, eczema of head and face) reacted best in the sense of an entire change: diminution of irritation and secretion, euphonic effect, locally antiphlogistic action, illustrated by a few clinical histories.

Then Peltesohn's experiences with the specific tuberculin treatment of Ponndorf of severe forms of ocular scrofulosis are reported, with clinical histories. This method consists in superficial scarification of the skin, analogous to vaccination, and rubbing in of a few drops of Koch's old tuberculin. The results in general were encouraging. The combination of the nonspecific with the specific therapy influences very favorably even severe cases with negative Ponndorf.

OPHTHALMIA AND DIET.—**Osborne** and **Menkel** studied the incidence of the eye diseases in a rat colony of 1,000 animals, to which no animals had been admitted from extraneous sources for several years. They were kept in the same laboratory. Their cages were sterilized twice a week, but they were regularly weighed in a common container, when there was opportunity for equal dissemination of contagion. They were not grouped according to any system of feeding. The records show that altho nearly one-half of the 1,000 rats were on diets undoubtedly deficient, not a single eye case was observed in animals other than those experiencing a deficiency in fat soluble *vitamins* in the rations. The incidence in this group was 50%.

Wason concludes that: The primary etiologic factor in the ophthalmia of rats on deficient diets is the fat soluble vitamins "A". The nature and mechanism of changes of these rats whereby their corneae are rendered susceptible to bacterial invasion is unknown: the type and virulence of organisms of the secondary infections determine in part the course of the disease: the anatomic manifestations of the disease are characterized by hyalinization or necrosis of the outer layer of corneal epithelium, exudation of serum and cells into the epithelium and stroma, and a proliferation of blood vessels and fibroblasts. In advanced cases, invasion of the anterior chamber and occasionally of the posterior chamber: the degree to which restoration is possible depends on the extent of the second injury. **Bloch** has reported a clinical investigation of xerophthalmia and dystrophy in infants and young children.

ACUTE CONJUNCTIVITIS FOLLOWING INJURY.—**Gifford, H.** reports the case of a man 40 years of age, showing an extreme degree of swelling of both lids of the right eye, with a pseudomembrane covering the lids and extending into the bulbar conjunctiva to the cornea all around, and several small pustules under the skin of the lids. The initial symptoms came on three days after something had gotten into his eye while working in the field. Two similar cases all occurring in farmers, and one from the same neighborhood as the first, were seen. The pneumococcus, xerosis bacillus, and a small gram positive spore bearing bacillus were present in the conjunctiva. He gives to the condition the term "Agricultural Conjunctivitis."

ARSENICAL CONJUNCTIVITIS.—**Milian** finds that the congestion of the conjunctiva which he noted ten years ago as a premonitory sign of poisoning from atoxyl occurs with all arsenicals. The arsenic induces a paralytic vasodilatation. This may be the first and only symptoms from arsenic poison, but warns of danger and calls for longer postponing of the next injection. A little epinephrin morning and evening may be useful, but the main indication is to ward off microbic infection of the eyes while the vasodilatation lasts.

HYDROGEN SULPHID CONJUNCTIVITIS.—C. M. S. states that he has seen a painful blinding conjunctivitis, sometimes lasting three to four days, without suppuration resulting from cleaning out oil stills. The writer has used potato poultices suggested by old time oil men, and believes them to be of value. The editor of the A. M. A. Journal believes the irritant to be hydrogen sulphid.

YPERITE OPHTHALMIA.—**Bussy** describes the gas lesions of the eye. There were more or less extensive burns of the lid border; intense conjunctivitis of the exposed portion of the globe and inferior culdesac, desquamation of corneal epithelium, miosis and congestion of the iris, blepharospasm, pain, sensation of foreign body, lacrimation and photophobia. He says it is a mistake to think that the corneal lesions are never severe. He has seen this membrane as white as milk. The treatment consisted in washing the eye freely and often with bicarbonat solution, the instillation of cocain and collargol. He found cocain ineffective. The drug par excellence was atropin.

FOLLICULOSIS.—**Oertel's** patient was a male, aged 20 years. The follicles were quite general over the conjunctiva of both upper and lower lids, the fornix, conjunctiva, and plica semilunaris and extended onto the bulbar conjunctiva. The membrane was swollen and there was a mucoid discharge. After wearing glasses correcting 3 D. of myopic astigmia against the rule and the application of an alum stick twice daily, the follicles disappeared in five weeks time.

ETIOLOGY OF TRACHOMA.—**Winski** had been struck by the fact that among 312 soldiers suffering from tuberculosis, 127 had trachoma, or what appeared to be trachoma. Two possibilities were present. Either that the tuberculosis patients had not been properly segregated and observed and an epidemic of trachoma had resulted, or there was a relation between tuberculosis and trachoma. An examination of 1,100 patients with tuberculosis in some form showed 241 with trachoma. The examination of the epithelium and the contents of the follicles for tuberculosis bacilli was negative in every instance. He found frequently in trachoma a microorganism, not acid fast, gram negative, blue staining cocci of varying size and at times arranged in pairs; blue, round or oval bipolar formations (free initial bodies of Lindner); mantel formed bodies; gram negative diplococci of the type of the micrococcus catarrhalis which were not gonococci. The first three described organisms he considers different stages of the same organism. As to the gram negative diplococci, he is unable to state whether it is an accompaniment, or whether it plays a role in the etiology of trachoma.

Michail states that contrary to usual teaching, he finds that chronic trachoma develops simultaneously in the superior and inferior culdesacs, but that the development differs in the two areas. If we draw two semicircles, one long situated on the superior culdesac, and one short on the inferior culdesac, one external and one internal, the external semicircle will contain the most follicles. It corresponds to a semicircle having the same form and extent as the lacrimal accessory glands of Krause, and extends from the outer canthus along the deepest portion of the superior culdesac to nearly the middle of the inferior culdesac. There is a slight hyperemia of the conjunctiva, especially at the outer angle, where in the inferior culdesac can also be found the initial lesions of trachoma. There is lacrimation aggravated by sudden change of temperature and light, and a filamentous secretion adherent to the caruncle and lower culdesac.

The lesions consist of two small lines of follicles converging towards the outer angle, and forming an acute angle opened towards the caruncle. The follicles are largest near the outer angle and smaller as the inner angle is approached. In more advanced stages, the follicles reach the inferior culdesac on the outer side, and become more and more aligned, the more elongated ones being in the deepest part of the inferior culdesac. Later there is a diffuse infiltrate resembling an edema of the conjunctiva of the culdesac. The development in the number of follicles and lines increases more steadily in the inferior culdesac.

In the upper culdesac, papillary enlargements appear along the superior edge of the upper tarsus. With a loupe they may resemble the enlargements of spring catarrh. A further development is a line of follicles 3/4 mm. below the papillary border corresponding with Krause's glands. They are fusiform. The secretion contains polynuclear neutrophiles, fibrinous filament and rarely epithelial cells. Scrapings show lymphocytes. The epithelial cells are granular and vacuolated. They are also polynuclear cells and fibrillae of the conjunctival surface. In the superficial epithelial layers are found a number of large vesicular cells, presenting all the phases of an actively secreting gland, and also nests of vacuolated polynuclear cells with hydrops, which increases the thickness of the epithelial layer.

Generally all the layers of epithelium are traversed by polynuclear cells, which with the capillaries of the skin go towards the surface of the conjunctiva to form the conjunctival secretion of chronic trachoma. The skin shows important changes in the vicinity of the lacrimal glands. The excreting ducts are lined by cells and mucus. There exists in consequence, a strong secretory reaction, the same as in the lacrimal glands of the conjunctiva. There is a marked lymphocytic infiltration of the glands. The periglandular tissue contains large, pale irregular polygonal cells, with large protoplasmic fields and a large eccentric nucleus, having much the same character as the chromatic granules in the trachoma follicles. He believes that the lacrimal glands of the conjunctiva are the port of entry of the trachoma virus, as the changes here are the only ones found in the early stage, and that this is due to the passage of the conjunctival vessels which become slowly infiltrated thruout the conjunctiva, as the chronic trachoma advances. **Gautier** wrote on the histopathology of trachoma.

According to **Nicolle and Cuénod** the experimental trachoma of the baboon has a long, if not indefinite duration, presents relapses, and may be complicated with keratitis. The trachomatous virus produces in the rabbit granulations lasting a year, and still virulent for the baboon at the end of that time. Transmission from rabbit to rabbit is possible. The virus is preserved (or cultivated) in the testicular tissue of the rabbit at least 37 days. An attack of trachoma (if it is really cured) does not protect the eye of the rabbit or the baboon from a reinfection.

Bartolotta discusses the question, "Is trachoma a specific disease?" **Santos Fernandez** points out the influence that a command of general hygienic conditions exerts on this disease. He reports a case living many years in the capitals of Europe, under most skillful treatment.

Hiwatari comments upon the fact that while he has found trachoma granules very rarely in the secondary pannus, some observers have met with them frequently. Sources of error in diagnosis may arise from the fact: (1) That the development of symblepharon may draw the fornix down towards the limbus, and it may come to lie just upon the limbus, and thus the granules appear as tho they had developed there primarily. (2) That a mixed infection occuring in the course of trachoma may cause minute granules to erupt upon the limbus. (3) The diagnosis of trachoma granules upon the limbus or cornea must depend exclusively upon the microscopic examination, in which their well known characteristics must be demonstrated.

Lindner found inclusion bodies in the epithelial cells of pannus. **Kooy** found the Prowazek inclusions in all cases of trachoma except a few old cicatricial cases. Free initial and elementary bodies were also found. Five times these formations were refound in inoculation experiments. The inclusion bodies are to be considered true organisms and not simple cell products. Trachoma in apes is considered proven.

Kleckowski and **Karelus** immunized rabbits with the red blood corpuscles of persons suffering with trachoma, and with the blood from normal persons. The serum of the rabbit sensitized with the trachomatous blood, hemolyzed the red blood corpuscles of persons affected with trachoma; while the serum from rabbits sensitized with normal blood did not. The authors believe that they have discovered a serologic test for trachoma.

Ashikaga.—At first the author noticed that in his examinations persons afflicted with swelling of the tonsils, are more easily affected by trachoma than others. Therefore, he believes that those who are inclined to suffer from hyperplastic adenoid tissue are more prone to be infected by trachoma. The author further asserts that the papillary swellings are easily visible after coloring with fluorescein solution; while the papillae appear as red dots and the surrounding channels are discolored yellowish. In trachoma the papillae are apt to be irregularly enlarged, while in simple conjunctivitis the papillae are generally of right size.

DIAGNOSIS.—**Ellett** says that on routine examination, in a child who has no subjective ocular symptoms, the condition of granulations on the conjunctiva is more apt to be folliculosis. If the granules are in the lower lid, and there are few other cases, and these in children of the same age, it is still apt to be folliculosis. Subjective symptoms, granulations on the upper lid and upper fornix, the presence of a similar disease in older members of the family or community, especially the scars indicative of a late stage of trachoma in the adults, require that the case should be viewed with suspicion, and withdrawal from school and the effects of the treatment watched.

Steiner describes the appearance of pigment flecks upon the tarsal conjunctiva of Javanese and other colored races. They appear as a sequel of trachoma, in the cicatricial stage. He also records the occurence of large tumors of the conjunctiva and tarsus, the result of amyloid degeneration.

Würdemann adds two cases of *monocular trachoma* to the three reported by him in 1896. All five cases were of special gravity, complicated by pannus and ulceration of the cornea. The disease had existed for varying periods of six months to as many years. Every clinician of experience must have seen a number of cases of monocular trachoma; they are so far from rare that they probably are not deemed of sufficient interest to report.

TREATMENT OF TRACHOMA.—**Staicovici** and **Lobel,** from observations of 12,000 cases, consider that the treatment of granular conjunctivitis should be that which offers the least possible destruction of the palpebral conjunctiva. Sulphat of copper appears to give the best results. If pannus appears, peritomy should be done. If deep ulcers occur, conjunctival injections may be used. The lacrimal ducts require attention. Where the papillae are so hard that a curette affects the surface only, they employ sugar sterilized with alcohol. The lid is held taut and a small amount of sugar is rubbed gently from one end of the conjunctival surface to the other. The angles are rubbed last and with particular insistence. The treatment is complete when the surface is clean, smooth and milky looking. The eye is bathed with oxycyanid of mercury 1:5000 twice daily, and protargol 3:1000 is instilled. At the end of five days a false membrane which covers the surface begins to peel off.

Brana emphasies the value of the copper pencil. Of 312 cases without pannus when they came under treatment, only six acquired this complication. The pannus disappears on the average in 13 days. He employs copper sulphat only when there is a profuse discharge from the conjunctiva. Granules he removes with his trachoma shears. Hypertrophies are treated with copper pencil. Most important is the daily stretching of the conjunctiva, especially the retrotarsal fold for which he has a special instrument. The upper fold of transition is to be treated while stretched over a Desmarres lid retractor. This will obviate the necessity of its excision.

F. M. Fernandez studied the effect of powdered ipecac on the conjunctiva of 5 patients suffering with incipient trachoma. In all of the patients a violent reaction, which lasted for 24 hours or longer, followed the application.

J. E. Fernandez wrote on the removal of the tarsus of the upper lid, in the treatment of trachoma, and **Mello** on the treatment of trachoma.

Addario la Ferla recites his experience with the method of Sculco in two hundred cases and reports twelve cases. The drug consists of resins and enzymes from sage, thyme and catnip. It is a yellowish-green powder with an inert vegetable powder added. The lid is everted and the powder is sprinkled on the conjunctiva. Its excessive action is limited by repeated washing, continued for fifteen days. The beneficial effect is noted in twenty-four hours. The action of the drug is said to be specific and does not produce reaction upon the normal conjunctiva. It is not beneficial in follicular conjunctivitis, spring catarrh or blepharitis. The action of the remedy is explained by the production of a phagocytosis and the stimulation of a bactericidal action. It is said to digest the pannus and to act favorably upon the scar tissue.

Story showed a girl 10 years of age who had severe trachoma of both eyes. When first seen, the right eye was considerably worse than the left. Story treated the right eye by Sculco's method (O. L. 1917, p. 38) for ten days before demonstrating the case. The right eye showed marked improvement following the treatment. **Balesi** reported the treatment of trachoma with naphthol camphor.

Aubaret states that the use of *vaccines* has little effect on the granulation, but alleviates the pain of the ulcers and accompanying iridocyclitis. The use of iodin vapor favorably affects the secretion and pain, but does not influence the granules. Complete covering of the cornea with conjunctiva is of value in relapsing ulcers. Brushing of the conjunctiva is the best treatment.

Jacqueau, Lemoine and **Arcelin** treated a patient 26 years of age who had suffered with trachoma for about four years. Three applications of *radium* were made at intervals of three weeks. Some improvement was noted immediately after the first application. After the third application the vascularity of the limbus had disappeared and the leucoma was less dense. One month after the last application no granulations existed in the conjunctiva of the upper lid. The cicatricies were very delicate, and the leucomae had cleared considerably.

Brana has devised a spoon for double eversion of the lids, an instrument for everting and stretching the lower lid, also a trachoma scarifier for curetting trachoma bodies.

Akiya treated 62 patients, mostly with remarkably good results. *Carbonic acid snow* was pressed upon the conjunctiva palpebrae and transitional fold for 20-30 seconds. Generally there was observed a severe inflammation, with a pseudomembrane, but without injury to the cornea. Applications were made once in 7 to 10 days, repeated several times. Results: (1) The trachoma bodies were absorbed quickly or were markedly diminished. (2) Papillae disappeared or diminished. (3) Trachomatous pannus and ulcerations were generally healed, especially when particles of snow were applied for ten seconds on the infected eyeballs and on the affected part of the cornea, which is not at all dangerous. Acute trachoma was not cured as readily, it taking about two months. Pigmented spots with scars (trachoma with scars) which is not rare, were rendered invisible after carbonic acid snow treatment.

Histologic examination was made several times, and the author could determine, that here occurred necrosis of the infiltrated cells which were in the granules and subconjunctival tissue. This was followed by inflammatory granulation in the bodies (granules), and in the other tissues, which soon were healed. The author thinks that this therapy has a great future, that the affected tissue can be reached deeply and certainly thru the necrosis of the infiltrated cells thru freezing. It does not depend upon hyperemia and edema as many authors, Montague and Harston believe. After application of the treatment on the cornea of rabbits, there appeared depigmentation of the iris.

David urges the systematic daily use of 1% solution of zinc sulphat containing adrenalin in the strength of 1/20,000, in all schools, factories, and other groups, in countries where trachoma is common.

Arana employed successfully the method of Abadie, but substituted *electrolysis* for the galvanocautery, after everting the lid. The needle, attached to the positive pole, was passed into the submucosa of the superior culdesac. A series of punctures parallel to one another and at right angles to the retrotarsal fold was made. There was no reaction following the operation. **Cupcea** reported the use of the galvanocautery for trachoma.

Blatt selected out of 2,000 trachoma patients. whom he treated in the first half of 1918 at the trachoma hospital at Targn-Muras, Dieberburgen, 150 of typical severe trachoma. Fifty of these were treated with *parenteral milk injections* alone, 50 with milk injections and locally, 50 with medicamentous and mechanical methods. Each group was again divided in 10 cases with chiefly trachoma granules, 10 with papillary exacerbations, 10 with diffuse edematous swelling. The treatment was uninterruptedly carried out for 3 months. The milk injections produced no local reaction on the eyes. Prowazek's bodies were present in the same quantities after injections as before, and there was no increase of leucocytes. The effect of milk injections on the trachomatous process was nil. A comparative table shows group results thus:

	Deteriorated	Improved	Unchanged
Group 1	22	0	28
Group 2	3	31	16
Group 3	4	34	12

Poyales discusses the medical and surgical treatment for trachoma and proposes an operation for the cure of pannus. The operation is done by removing a triangular piece of tissue, which includes conjunctiva and the vascular portion of the corneal pannus. The apex of the triangle is directed up in the conjunctiva, and the base is down on the cornea. A triangular piece of mucous membrane is then taken from the lip and placed in the eye wound where it is held by sutures. The sutures are removed after the sixth day.

Birnbaum, from the treatment of 800 cases during the war, states that in the first stage nitrat of silver 2:1000 is the best agent. In the second stage, the expression of the granules. In the third stage, expression by pressure from the conjunctiva and skin surfaces. Later sulphat of copper.

Dimitry, before practicing his method of mechanical *manipulation of the tarsus* in the treatment of trachoma, removes all secretion by the use of a one half of one per cent aqueous solution of *mercurochrome* or a zinc solution two or three times a day. A single sitting under anesthesia is required. A heavy piece of copper wire, of the size used for street car cable, of a length of about eight inches, bent about two inches from the end is used. The rod is wrapped evenly and carefully with cotton for the distance of the bent portion, just sufficiently that it may be easily inserted under the everted tarsus. The lid is everted and the probe, after being dipped in sterile water is inserted under the tarsus and with the thumb holding the everted lid, pressure is made with the probe up towards the thumb and the thumb is pressed towards the probe, causing the tarsus to bend and at the same time the probe is rotated. This manipulation presses out the contents of the follicles and depletes the infiltration. This is to be repeated until all the follicles are emptied. The tarsus becomes pliable and soft. It is claimed that this technic does not produce scar tissue.

Cowley says that the only satisfactory treatment is *operation.* In the early stages the conjunctiva can be stripped clean with forceps, rubbed with a tooth brush dipped in 1:100 bichlorid and wiped with gauze, after the method of McMullen. Cure is almost certain.

Liebermann says that *expression* and *grattage* must be done with the completely everted conjunctiva over an eversion instrument. The two methods supplement one another. Massage with a glass rod is very valuable. The indications for conjunctival resection are very limited. Direct treatment of pannus is of little value. In cicatricial entropion, tarsoplasty after the method of Blaskovics is an efficient treatment. Limited entropion is treated by the Spencer-Watson operations.

Tertsch's experience with 5,000 cases of trachoma, treated conservatively and by operation, was that no method materially shortened the stay in the hospital. While the Knapp and Kuhnt expression method was helpful in the follicular type, it had no effect in the papillary variety. It was not altogether harmless. For recent cases excision of a small portion of the conjunctiva is warmly recommended. The Kuhnt-

Heisrath method of excision of the retrotarsal fold was forbidden. In 54 cases of marked thickening of the upper tarsal border and of the superior retrotarsal fold, by excising a 3-4 mm. wide strip good results were obtained. He practiced abrasion with a brush combined with massage with a glass rod similar to the method used also by Imre and Bernheimer.

Meyerhof recounts the surgical procedures employed in the treatment of trachoma in Egypt. In refractory cases energetic curettment of the conjunctiva with a sharp spoon is employed. Canthoplasty is indicated not only when the lid fissure is narrowed, but in fresh trachoma. K-H operation is favored in pannus. For entropion the Hotz operation suffices in most cases. In ectropion Kuhnt's operation is mostly used. **Walsh** states that there is no drug, or chemical, or light ray that has any selective action on the trachoma granule. All treatment depends on the formation of scar tissues. The most effective method of producing such tissue is by the removal of the conjunctiva with the tarsus. It is equally effective with or without mucous grafts.

Tenner describes a specially designed knife with blunt end and blade at right angles to the shank, a lid forceps, modified Falta entropion forceps, two mouse toothed forceps and a suture forceps with one blade mouse toothed, the other serrated, for resection of tarsus and conjunctiva. He believes that the combined operation affords the only means of quick eradication of trachoma and prevention of its complication and sequelae. He uses local anesthesia, first by rubbing the surface with cotton dipped into epinephrin solution then in pure cocain crystals. Five minutes later an injection of 1% epinephrin-cocain solution is injected into the conjunctiva of the fornix, so that the latter balloons. The needle is then thrust farther in, penetrating the tarsus and more solution is injected, especially about the inner canthus which is especially sensitive. The injection seems not only to demarcate the diseased tissue but disects the conjunctiva by lifting it up. He reviews 300 cases in which combined excision on the conjunctiva was performed. The indications are: active trachoma with evidence of cicatricial tissue, or those cases in which the development of granulations and thickening show that cicatricial tissue is inevitable. If there is pannus it should be done to relieve the pannus. If there is no pannus, it should be done to prevent pannus. Local anesthesia is preferred. The anesthetic is used in such a manner as to separate the conjunctiva from the underlying tissues, thus doing with fluid what is usually done with instruments.

Torok, in discussion, considered the indication for the operation to be: that *excision of the culdesac* is indicated where the conjunctiva is hypertrophied, the epithelium thickened, and the presence of a large number of follicles in the culdesac which run together into a gelatinous mass. Combined excision is indicated in cases similar to the above, where the tarsus is also thickened and infiltrated, if it contains follicles and if it shows beginning cicatricial contraction. In cases where, in spite of treatment no improvement is obtained and pannus is present, where ptosis is present, where one eye is affected, excision of the tarsus is indicated; and in old trachoma cases, where there is cicatricial contraction of the tarsus. All three operations are contraindicated in fresh cases and in very old cases where the conjunctiva is greatly shortened. Wootton is convinced that the Heisrath-Kuhnt operation constitutes the only efficient treatment in which pannus is threatened or present. Berens has not found it necessary or advisable to excise the tarsus even in the presence of marked pannus, except to correct ptosis. **Santos Fernandez** discusses excision of the cartilage of the upper lid in comparison with other operations for trachoma.

In a review of the results obtained in his cases of fleshy pannus of the cornea treated by the various methods advocated, **Seddik** found that he got the most satisfactory results by the combined scraping of the pannus from the cornea and excision of the tarsus and conjunctiva of the upper lid.

Morax treated a patient with trachoma, who was infected during the war, after the method of Abadie, after many other procedures had failed. Fifteen days later, the patient who previously had been unable to go about alone was enabled to open his eyes and was much improved.

Engelking reports an epidemic of conjunctivitis, which occurred in Freiberg, which clinically resembled trachoma but was very much milder in its course. **Burnier** wrote on the treatment of trachoma.

Blanco proposed to the ophthalmic society of Spanish America, that it carry out a crusade against trachoma by inviting the various governments to establish schools for isolation, clinics for treatment, and laboratories for the study of the disease.

DISTRIBUTION AND PROPHYLAXIS OF TRACHOMA.—Switzerland is actually immune from trachoma. Out of 200,000 eye patients seen by **Haab**, only 16 Swiss natives had been infected in that country by foreigners. All other cases of trachoma occurred in foreigners. This corresponds with the observations of Romer and others. **Santos Fernandez** reports a case illustrating the relatively benign course of trachoma in the tropics under some hygienic care. **Telavivi** has described trachoma in Palestine. The investigations of **Petit** show that the protectorate of Tunisia is infected by trachoma, which while drawing so much less attention than certain acute infection, is causing total or partial infirmity to thousands and incapacitating them for work. At Gafsa, in a population of 5,000, he saw over 1,200 cases. In some of the schools as high as 98% were affected. The mildness of the subjective symptoms was remarkable. Manual transmission seemed to be most frequent. **Young** sums up the status of the questions as to whether trachoma is contagious in part as follows: The existence of a specific trachoma germ is a remote possibility; where trachoma abounds, flies also abound; there is no proof that the fly by mere contact spreads the disease; nor that it spreads through interhuman contact, tho there is a marked recession in the well to do, so marked that it ceases to be a family disease, and along with this recession there has been inaugurated only one sanitary measure of significance: to-wit, combat the fly. **Krückmann** states, that in recent inflammation it is well known that both lids, especially the lower lid, take part in the narrowing of the fissure. There is no real ptosis due to weight and thickening of the tarsus, but there is a marked resistance encountered. The *ptosis* is in the chronic stage after the disappearance of inflammatory symptoms. This is partly due to deep infiltration which produces disturbance and loss of elasticity in the lid and vicinity. This does not explain, however, the ptosis which develops rapidly when other visible changes are minimal. He believes it possible that paralysis of the tarsal muscle is a factor, but the proof of this will require the investigation of many cases.

Archimbaud and **Chauvin** give a general review of the pathologic anatomy, history, geographic distribution, the results of animal experimentation, the methods of prophylaxis, symptomatology and treatment. They state that the horse and dog are subject to forms of conjunctivitis closely resembling trachoma in man. The causes favoring contagion are flies, personal contact, soiled linen, previous conjunctivitis and certain fruits, such as the Barbary fig, with numerous spores which are blown by the wind into the eye. They state that true trachoma can seldom, if ever be cured, and often cannot be ameliorated.

An Editorial in the *Journal of the A. M. A.* says it is generally known that trachoma is highly contagious. There is no evidence that it is caused by a microorganism of the bacterial or blastomycetic group. The Prowazek bodies are quite characteristic of trachoma but not the cause. Eaton and others believe that the virus is endogenous, and the most potent means of transmission in interhuman contagion.

Nicolle and **Cuénod** endeavor to show that a fly may transmit the disease for 24 hours after having been in contact with infectious material. They found that the infectious agent is a filterable virus passing the Berkefeld V. filter, that is destroyed by heating to 50°C. for one half hour, and that it may be preserved in glycerol at ice box temperature for seven days. Chimpanzees, baboons and rabbits are susceptible. The virus has survived five successful transfers from rabbit to rabbit, and has been recovered from the eye of a rabbit one year after inoculation. They find that a primary attack of trachoma does not protect the eye of the rabbit or monkey from experimental reinfection.

Petit read the report of a committee before the Society of Ophthalmology of Paris, which had arrived at the following conclusion: That obligatory declaration will only be of utility, if special regulations and corrective measures are supplemented. There is little analogy between trachoma and other epidemic diseases in point of contagion. It is rare in trachoma in France.

Fernandez attributes the relative mildness of trachoma in the tropics to the fact that people do not live crowded so closely together as they do in colder climates. The ravages of trachoma in colder climates can be controlled only by the opportunity of the inhabitants for living under hygienic conditions. The same author states that he has seen only two cases of trachoma in people of wealth and station. One was in a woman of 50, who is still living at the age of 90. The astounding increase in the number of cases seen in Marseilles **Aubaret** attributed to the influx of immigrants from Africa, and the Far East. Treatment by autogenous vaccines reduced inflammatory complications. Iodin vapor against the everted lids reduced secretions and pain. Granulations were crushed or brushed, and antiseptics and astringents used.

Yandell and **Benedict** discussed their methods of treating trachoma, **Hilgartner** wrote an article on trachoma, and **Wernicke** points out the danger of the wash basin as a source of conjunctival infection.

FOOT AND MOUTH DISEASE.—**Oscher** and **Klaube** have found both corneal and conjunctival affections in children infected by the milk of cows with foot and mouth disease. In one case the conjunctiva alone was affected. Both the conjunctiva of the lid and the ball were swollen, and there was a mucous discharge.

STREPTOTHRIX CONJUNCTIVITIS. — **Bakly** reports three cases of this rare affection. The first was in a boy 13 years old seen at Beui Suef. The right eye was found infected. The second case was a woman 22 years of age seen in Minia. The right eye was swollen and had mucopurulent conjunctivitis. The M.-A. bacillus was the causative microorganism, but the eye was infected with streptothrix. The infection gave rise to no acute symptoms, so that its duration is unknown. On raising the upper lid and on downward rotation of the globe the upper-inner quadrant of the globe, and fornix was pinkish. Small hard, yellowish nodules, from five to twelve in number, slightly longer than a pin's head were seen in this area. Bakly believes the organism to be the actimomyces bovis seu hominis.

LEPTOTHRIX IN OPHTHALMIA.—**Gifford, S. R.** found a strain of leptothrix as the only organism in smears and cultures from the conjunctival sac in a case of recurrent conjunctivitis. It was pathogenic for guinea pigs and showed definite spore formation. The group of leptothrices includes at least two, and probably more, distinct species.

MOLLUSCUM CONJUNCTIVITIS. — **Gifford** and **Gifford** record the histories of six cases of molluscum conjunctivitis, in which the growths were removed and diagnosed by sections. The description of one case suffices for all. The patient was a boy of 14 years of age, who had been treated for blepharitis for 18 months. After six months he appeared with an acute conjunctivitis of the right eye, the inflammation being much marked on the lower fold. There was a small nodule at the center of the right lower lid, which showed no central depression and was taken for a wart. It was removed and showed the typical picture of molluscum contagiosum.

One of the pieces was placed in a subcutaneous pocket of the forearm of one of the authors, where it remained until it was absorbed without even causing any irritation or newgrowth. They conclude: that molluscum conjunctivitis may attack the skin of the lids is well known; that it may cause conjunctivitis which is not well known to ophthalmologists; that a single molluscum nodule on or near the lid margin, even without the destructive umbilication, may keep up a troublesome conjunctivitis or even an ulceration of the cornea which resists ordinary measures, but which heals promptly on the removal of the nodules seems to be practically unknown.

PARINAUD'S CONJUNCTIVITIS. — **Benson** and **Clay** made this diagnosis of a case of conjunctivitis in a female 72 years of age. There was a history of previous attacks of follicular conjunctivitis during the four years previous. The palpebral conjunctiva was thickened, with small polypoid elevations on the bulbar portion. Pannus developed. Five months later there was an acute exacerbation, fever, and enlargement of the neighboring glands. The conjunctiva now showed cobbled like elevations, yellowish red in color. The bulbar conjunctiva was equally involved and the semilunar fold a polypus like mass. The cornea was clear. Histologically the conjunctiva showed pure lymphoid tissues. Radium was applied and resulted in rapid subsidence of the subjective symptoms, but slow improvement of the objective.

Bell's patient was a physician 30 years of age. The characteristic lesions were present. The preauricular gland underwent suppuration. The temperature rose to 104°. Only a staphylococcus albus was found. After five weeks of the usual treatment for septic conjunctivitis, the edema of the lids and conjunctiva had disappeared and the granulations were absorbing.

Beauvieux has observed three cases. He states that the disease is produced by a microbe, the nature of which has not yet been determined. **Cantonnet** adds that the discovery of **Pascheff** of a microbacillus polymorphus necroticans is of interest in this connection. In the diagnosis it is necessarv to eliminate streptococcic conjunctivitis, syphilis, sporotrichosis and tuberculosis of the conjunctiva.

Pascheff reports four cases and describes the symptoms. The palpebral conjunctiva becomes thick and red, in the culdesac appear little points or spots, white and flat, about the size of millet seeds with diffuse borders, which disappeared in the redness of the secondary conjunctivitis. Some were elevated, others excavated, and ulcerated like phlyctenules. The treatment consisted in irrigation of the conjunctival sac with 1:4000 sublimat solution, hot compresses and iodin ointment.

Butler reported a case of Parinaud's conjunctivitis in a child.

SECONDARY CONJUNCTIVITIS. — **Paul** states that this type of conjunctivitis with *measles* has received but passing attention. It is generally considered to be due primarily to the actual causative agent of measles. He relates a case in which death occurred on the third day after the appearance of the rash. The changes met with histologically in the conjunctiva and lids were edema of lids, in general, dilatation of the meibomian glands. Primary *erysipelas* of the conjunctiva, which is a very rare affection, is reported by **Deutschmann.**

CONJUNCTIVITIS WITH STOMATITIS.— **Hartlev** states that the association of pseudomembraneous stomatitis with conjunctivitis and its relation to erythema multiforme and pemphigus was first reported by Fuchs in 1876. The ocular symptoms are bilateral, acute inflammation reaching its height in a few days. There is a peculiar torpid conjunctivitis with a gross soft ulcer of the lids. On eversion the entire tarsal conjunctiva is found covered with a yellow, or yellowish white, 2 to 3 mm. thick, pseudomembrane, with a surface smooth and easily separated from the conjunctiva, which is found slightly swollen, red and covered by a serum. This exudate coagulates in a few hours into a fibrinous membrane, which may disappear spontaneously or by slight manipulation, and is renewed. The bulbar conjunctiva is either injected or normal.

The course is from two to three weeks or more. During this period there is no constitutional disturbance. There may be no sequelæ or cicatrices and symblepharon may result. Either a superficial or perforating keratitis may occur. The eye may be lost and the patient develop edema of the lungs or pneumonia. Most authors agree that the condition is pemphigus of the conjunctiva without cuticular pemphigus. He records two cases in which these ocular symptoms were associated with an eruption upon the mucous membrane. The only organism present was the staphlyococcus. The general condition was diagnosed as erythema multiforme. The author states that between the typical cases there is a middle group more nearly resembling the group here described.

PAPULE OF THE CONJUNCTIVA.—**Toulant** records three cases of a papular affection of the conjunctiva without apparent cause, and without adenopathy or general symptoms. The papule was single and nonpainful. The center stained feebly with fluorescein. It continued three or four weeks. Bacterologic examinations were negative.

LEPROSY.—**Neame's** patient was seen in England. The infection occurred in India. There was widely extended eruption over the body and the mucous membrane of the nose was ulcerated. The discharge contained lepra bacilli. The pupils were fixed. The lids and surrounding tissues were infiltrated and edematous. Under the use of intravenous injections of sodium chaulmoograte, in the judgment of the patient some improvement had resulted.

TUBERCULOSIS.—**Marin Amat** reports a case of primary tuberculosis of the bulbar conjunctiva secondary to subacute pulmonary tuberculosis. The patient was 22 years of age. There was a mass on the superior nasal quadrant of the bulbar conjunctiva, between the superior rectus and the internal rectus. It was hemispheric in shape and of a violaceous hue. The apex was yellowish and showed caseation. There was an adenitis. There was no pain or fever. There was a regional lymph swelling, and marked cutaneous reaction to tuberculin. Under treatment the conjunctival mass disappeared. Following this the patient's health, which had been excellent, began to fail and in a few months he died of pulmonary tuberculosis.

Bergmeister's patient was a male 38 years of age who had suffered from an inflammation of the conjunctiva and cornea of the right eye. There were five or six recurrences. Then after an interval of eight years there was another attack, for which he was treated with 60 injections of tuberculin. The eye became quiet with a resulting corneal scar. Some months later there was a fresh attack. In the upper-outer quadrant of the conjunctiva, at the limbus, there were two yellowish gray ulcers. The cornea was thruout flattened and dull and in places uneven and presented numerous superficial and deep vessels coursing thru a diffuse interstitial dense grayish yellow opacity. The lower-inner quadrant was unaffected. The iris was discolored and the anterior chamber shallow. The Wassermann was negative.

SYPHILIS OF CONJUNCTIVA.—**Camison** and **Celada's** patient, a child four years of age presented a tumefaction, edema and a localized induration but without either ulceration or erosion. The neighboring glands including the parotid was indurated. The skin presented a papulosquamous eruption. The Wassermann was strongly plus. There was a rapid subsidence from salvarsan. A second case, also in a child, presented much the same clinical symptoms.

Kubik's patient was an infant, aged seven weeks, presenting the clinically well defined picture of syphilitic conjunctivitis. There was dense, pale swelling of the ocular conjunctiva, owing to diffuse infiltration with lymphocytes and leucocytes and plasma cells and proliferation of connective tissue, similar to edema. The tarsal conjunctiva showed a peculiar pale yellowish swelling with intact smooth surface, no papules or gummatous changes. After thoro irrigation a smear from the epithelium of the tarsus revealed in dark field illumination numerous moving spirochetes. During the three days the patient stayed in the hospital, the conjunctival affection remained the same under mercurial inunctions, while the associated parenchymatous keratitis and iridocyclitis, of the early occurence of which only few observations exist, increased in intensity.

Marin Amat met with three cases in 35,000 syphilitics.

1. Chancre of the conjunctiva of the lower lid, with intense complete healing in sixteen days under local treatment and combined neosalvarsan and gray oil. 2. Chancre of the lid border with the clinical picture of hordeolum in the beginning. The same treatment resulted in a cure. 3. Chancre of the upper lid with almost complete destruction of the conjunctiva. Healing in forty days under neosalvarsan, mercury and K. I.

XEROPHTHALMIA. — **Guerrero** and **Concepcion**, in their experimental work on the biologic assay of different tikitiki extracts, found that of 30 fowls which received polished rice and 5 mils of tikitiki extract daily, 5 developed polyneuritis and 7 developed xerophthalmia and died. The ocular condition appeared from the 7th to the 79th day of the experiment. They deduce from this: (1) That polished rice is lacking not only in water soluble B which prevents polyneuritis, but also in fat soluble A, which presides over the process of growth and prevents the occurence of xerophthalmia. (2) That tikitiki extract contains the water soluble B but does not contain the fat soluble A. **Emmett** writes on fat soluble vitamins and xerophthalmia.

CHRONIC PSEUDOMEMBRANOUS CONJUNCTIVITIS.—**Brunetière** saw a patient who had been afflicted with a chronic pseudomembranous conjunctivitis, since the second year of life. It was localized at the tarsal conjunctiva of the upper lid of the right eye, and resulted in corneal lesions and atrophy of the globe. It had resisted all treatment, including antidiphtheritic and antistreptococcic serum. Bacterial examination failed to identify the organism.

COCCIDIAE IN THE CONJUNCTIVAL SAC. —**Sakaguchi** found the coccidiae frequently in the conjunctival sac in the inhabitants among whom he lives (Province of Yamayata); and describes several methods of staining.

BACILLUS PRODIGIOSUS IN CONJUNCTIVAL SAC.—**Mazzei** found that when the bacillus prodigiosus was introduced into the conjunctival sac it caused a catarrhal conjunctivitis.

PEMPHIGUS OF THE CONJUNCTIVA.— **St. Martin** relates a case of pemphigus of the conjunctiva, in which specific treatment sufficed to arrest the progress of the disease. He believes that the cause of pemphigus of a cutaneous-mucous location or exclusively mucous is hereditary syphilis. The stigmata of syphilis are present in all cases of pemphigus of the conjunctiva.

Ruffer's patient was 39 years of age. The disease was of about two years duration. In the right eye there was thickening of the palpebral and bulbar conjunctiva, in places elevated, in which places there were trachoma like scars and also total adhesion of the lower lid to the globe. The cornea was overgrown and the conjunctiva epidermic. There was also symblepharon of the upper lid. Nine months later lesions of the mucous membrane and blebs of the conjunctiva appeared. **Nielsen** has written on pemphigus of the conjunctiva.

In **Wood's** case the diagnosis was rendered difficult by the fact that the patient, a Jew, 19 years of age, gave a history of having had trachoma. The left cornea was opaque and was very hazy and vascular. The outstanding features were the absence of redness of the eyes and lids and the dryness of the cornea. He had pityriasis circinata on the chest, tenia versicolor on the back, facial acne and a few pemphigus bullae. A bacterial examination showed an *aurococcus* present in the blebs upon the body. Moderate success followed grafting of the conjunctiva around the cornea. Covering up of the eye, however, during the relapses seemed to give the greatest relief.

AMYLOID DEGENERATION.—**Sato** reports two cases of amyloid degeneration of the conjunctiva. From the histologic examination, the author concludes that the degeneration has its origin in the plasma cells and connective tissues. Fatty infiltrations were also observed. **Ono** also reports amyloid degeneration of the conjunctiva. He thinks it is hard to say whether the degeneration originated from the plasma cells, or connective tissue. The walls of the vessels were surrounded, like the bark of a tree, with amyloid layers.

RARE CONDITIONS OF CONJUNCTIVA.—**Ravdin** reported a case of *xeroderma pigmentosa* in a girl 9 years of age. The first signs of the disease were noted over the nose. The face and head were involved. The condition progressed and extended to the eyelids and conjunctiva,

Evans saw a man who had multiple *capillary nevi* on the conjunctival surface of the upper lid. The thin walled vessels ruptured frequently and caused recurrent hemorrhages.

Charlin states that *subconjunctival hemorrhages* indicate an alteration in the cardiovascular system. He reports two cases in which advanced cardiorenal changes had occurred.

Deutschmann reported rare affections of the conjunctiva. A woman of 46 years had a swollen and injected conjunctiva. Her eyes had never teared. The second case was one of atrophic conjunctivitis. In a patient who, five months previously had a slight injury to the right eye, **McIlroy** noticed a small white speck at the outer corneal limbus, which proved to be the swollen coat of an *eyelash*, which was embedded in the subconjunctival tissue.

HORN OF CONJUNCTIVA.—**Stock** observed on the lower temporal portion of the limbus a prominent, whitish, dry tumor, 1.5 mm. square, like a xerotic spot, in a man, aged 53. A second patient, aged 50, exhibited a similar tumor at the nasal limbus, encroaching a little on the cornea. The tumor of the first patient was removed. Under the epithelium was a narrow, uniformly staining stratum, with strikingly few nuclei, resembling the formations in vernal catarrh. It contained granules, which must according to staining and appearance, be considered as embedded anyloid. The epithelium of the cornified part was about 4 times as thick as the normal epithelium. At the surface the cells were converted into anuclear stripes, which could be easily lifted.

Stock considers the affection as a primary subepithelial alteration, leading secondarily to the cornification of the epithelium. As the disease was in both patients in the region corresponding to the palpebral fissure and as both came from the same place, Stock attributes it to some lesion, which, however, could not be ascertained.

FOLDS OF CONJUNCTIVA.—**Braunschweig** saw this condition in a man who for years had complained of pain in both eyes on closing the lids. There was a narrow lip like fold of the ocular conjunctiva which disposed itself on the intermarginal edge of the lower lid. The bulbar conjunctiva could be raised in folds. The condition was assumed to be due to a diminished elasticity of the membrane due to loss of elastic fibers. A half-moon shaped piece of the conjunctiva at a distance of 5 mm. from the corneal limbus was excised. Relief was permanent.

PTERYGIUM.—**Cosse** describes a case of monocular bilateral pterygium in which he operated in the following manner: After elevating the head of the growth,. and resecting all or part of the body, an autoplastic conjunctival flap is made, nearly rectangular and vertical and fastened by sutures to the sclerotic superficially, and placed very high under the upper lid. Where the loss of corneal tissue is considerable, it is covered by a superficial layer of the cornea, taken from the upper part of the same cornea. This autokeratoplasty and method of suturing he believes to be original.

Bistis removed a pterygium which contained an epithelial cyst, and described the histologic findings. The author then discussed the various kinds of conjunctival cysts and quotes some of the literature on the subject.

Yano describes the structure of a cyst in a pterygium. It consisted of laminated pavement epithelium, without any degeneration, and subconjunctival connective tissue with some blood vessels. The interior of the cyst contained yellowish material, no gland tissue nor bone.

A second case had a small white opaque mass at the nasal margin of the cornea of the right eye, of five years duration. It did not increase in growth until 2 months before being seen by the author. There was a membrane arising from the inner two-thirds of the lid, 2 mm. from the margin, and firmly adherent to the lower outer quadrant of the cornea. It was composed of laminated epithelium without degeneration, and of subconjunctival connective tissue, thickened and vascular. The case resembled a psuedopterygium, but there was no history of ulceration. It differed from a congenital anomaly in being progressive. **Xilo** has written on conjunctival cysts.

Terson states that his operation consists essentially of resection of the growth followed by a rectangular conjunctival autoplasty with fixation of the suture to the sclera as high as possible, with autokeratoplasty if necessary. **Mendoza** describes the treatment of pterygium.

De Lapersonne states the indication for operation is the increase in the growth of the pterygium or the presence of astigmatism against the rule, caused by the flattening of the horizontal meridian. He recommends Terson's operation of transplanting the pterygium behind a conjunctival flap. The corneal area can be cauterized and covered by an orthoplastic flap, or one from an enucleated eye or rabbit's cornea. Recurrences are not prevented by grafts from the lip or conjunctiva. Bonnefon has used the pterygium turned around as a covering for the denuded surface.

Pacheco Luna describes McReynold's method of transplanting pterygia.

EXTENSION OF CONJUNCTIVA UPON CORNEA.—**Wood** saw a symmetric encroachment of the conjunctiva on the corneal margin for a distance of two to two and one-half mm. wide, with the conjunctival vessels continued into it. With a fine probe the conjunctiva could be separated from the cornea. The patient was an elderly man who had been treated for cellulitis at the root of the nose, and pus had been evacuated from the eyelids.

SYMBLEPHARON.—**Friede** describes in detail the method pursued to correct a previously treated symblepharon. The Esser inlay was used. Three factors are necessary for success. Radical excision of the scar tissue; extension of wound surface, localization of the wound at the periosteum of the orbital cavity. The site of anchorage may be: the skin of the lid, at the newly formed conjunctival pocket; the periosteum at the orbital edge; the bulbus itself, which the author adopted in the present case. All scar tissue was dissected out except the one conjunctival scar tissue fold in the region of the lower lacrimal point, extending to the edge of the cornea, to which to attach the suture. The Thiersch graft was folded about a stent model, after the manner of Esser. Two sutures held the inlay, one at the scar fold, the other at the outer canthus. After four days the graft was firmly adherent to the sclera, and showed only a slight tendency to shrink. A good result was secured.

Kalt to overcome the difficulty of keeping the epidermic flap in position uses a simple ring of brass 30 mm. in diameter and 3 mm. thick placed between the lids and the globe. It did not touch the cornea and was worn three weeks without discomfort.

CONJUNCTIVAL DISEASES IN TSINAN.—**Neal** noted a marked increase in cases of conjunctivitis treated in 1919. About 3/5 of all eye cases were forms of conjunctivitis. One-half of these cases were simple types. Phlyctenular conjunctivitis constituted from 1/6 to 1/7 of all the cases. He notes the occurrence of the solitary bulbar conjunctival phlyctenules for which he suspects in some cases a tuberculous cause, altho they yield readily to ordinary treatment. Granular conjunctivitis represented from 1/6 to 1/7 of the cases. He states that foreign children were infrequently affected. Out of 1952 cases there were but 16 cases of purulent inflammation. Pterygium is very common.

Agatston has written on the diagnosis of conjunctival diseases by the general practitioner. A similar article has appeared by **Abelsdorff**.

Gabrielides has published a monograph of 760 pages on affections of the conjunctiva. There is a bibliography of 100 pages.

THE CORNEA AND SCLERA

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This section reviews the literature of 1921. For previous references see Ophthalmic Literature, 1921, v. 17, p. 91.

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DIGEST OF THE LITERATURE

ANATOMY.—**Lüssi** found with Gullstrand's slit lamp exact measurements of the thickness of the cornea. He reports 2 cases and shows that occasionally considerable and extensive thinning of the cornea need not be followed by ectasia.

Friede reports a case of cornea plana in a woman aged 43. The cornea had the aspect of a flat glass plate, and was smaller than normal. With Wessely's keratometer it measured from 8.5 to 9 mm. It appeared still smaller than it was by the encroaching parts of the sclera. When they were added the diameter was from 9 to 9.5 mm., and from 9.5 to 10 respectively. It also was more striking as the remaining portion of the eyeballs were not microphthalmic. The refraction was hypermetropic astigmatism. In other cases this fluctuated from + 7.00 to — 9.00, so that not a shortened but normal and even enlarged sagittal axis of the globe must exist. Friede considers, with others, cornea plana as a malformation, not a result of inflammation. Two groups of microcornea are distinguished, and the characteristics of cornea plana and true microcornea are placed in tabular form.

Attention is called by **Verderame** to the visibility of the nerves in the cornea of an inflamed eye. His patient suffered from acute iritis with intense pain; and in the cornea were seen by oblique illumination and enlargement with an 18 D. lens fine whitish threads perpendicular to the margin of the cornea and growing finer as they approached the center. They divided usually dichotamously and the finer branches showed anastomoses. Under antiluetic and proper local treatment, the eye grew rapidly better and the whitish lines progressively disappeared. The relation of the nerves to the corneal tissue is the subject of a paper by **Nageotte.**

Verderame reports a case in which the cornea had the form of a vertical ellipse. The patient had seen well until 21 years of age when he suffered a bilateral parenchymatous keratitis. The horizontal diameters of the cornea were 11 mm., the vertical 16 and 17 mm. The ophthalmoscope showed a focus of specific chorioretinitis.

Schnyder records many observations of the normal and of the pathologic endothelium of the cornea, as revealed when examined with Nernst slit lamp. The article does not lend itself to a brief digest.

NUTRITION OF THE CORNEA.—**Kumagai** made an experimental study on the cornea of the rabbit. He found changes in the endothelium of the cornea after bringing air into the anterior chamber, after emptying the aqueous. This he believes proof that the fluid of the anterior chamber shares in the nutrition of the cornea; furthermore, he found many oxydase granules in the endothelium.

With the thought, that eserin accelerates the circulation of the aqueous humor, and thereby raises the nutrition of the cornea, while atropin decreases it; the author examined the influence of both remedies on the epithelium and the endothelium. He could not find any difference worth mentioning.

Recalling the favorable influence exerted in certain grave corneal processes by perforation of the cornea, **Colombo** conducted some experiments on rabbits in an endeavor to study the reason why this perforation should act so favorably. On making equal and symmetric, bilateral wounds at the center of the cornea, and applying in these wounds an emulsion of fluorescein, the diffusion of this substance, (if the endocular tension was kept strongly lowered by repeated paracenteses) took place in a manner notably more rapid than in the eye on which paracentesis was not done.

Marx has found that the cornea possesses a low degree of sensitiveness to temperature, which is very difficult to detect. The author gives a number of diagrams showing the sensitive and nonsensitive points of the cornea. He concludes from these tests that the sensitiveness of the cornea increases from the periphery toward the center.

Hoffmann reports the results of his researches on the histologic changes, and on the regeneration of the cornea thru erosions with solutions of lead salt. The experiments here in question show clearly that the sole function of the epithelial cells is to build new epithelium. The author's investigations confirm the opinion of **Hanke** that the parenchyma of the horny layer is regenerated by the fixed horny layer cells, that the epithelium takes no part in this reconstruction process, and that Descemet's membrane is replaced by the layer of edothelial cells.

EXAMINATION OF THE CORNEA.—For contact illumination of the cornea **Graves** uses a small 4 volt electric lamp, set into the end of a metal tube and capped by a disk of glass, flush with the smoothed end of the tube, so that it may be placed in contact with the eye without danger of injuring that organ. This is described as the best means of procuring the desired illumination. The entire instrument is very much like the transilluminator ordinarily employed in accessory sinus examinations. Brought into contact with the cornea, at the corneoscleral junction, the pencil of light may be directed so as to permit inspection of the corneal surface or of the iris and anterior capsule of the lens. Minute changes in these structures may be further studied under such illumination by the aid of a magnifying loupe. (See p. 5)

Many years have been devoted by **Mendoza** to the study of methods for restoring transparency or supplying it to an opaque cornea. He thinks that some degree of success has been obtained by the use of subnitrat of bismuth in recent cases with slight opacities, but everything has failed with total opacity, even to grafting another human cornea. Mendoza has studied the possibility of seeing thru the sclera. The author has operated for staphyloma, turning the eye inward, completely detaching it from the muscles, the conjunctiva, and Tenon's capsule, and then fastening the sclerotic insertion of the right external rectus to the internal rectus. When the posterior part of the eye was presented to the light, the patient could perceive light clearly and indicate the window, which confirmed his idea that the sclera is translucent.

According to **Haab** it is possible to examine one's own eye almost under the same conditions as another's by proper illumination of the eye with the Gullstrand lamp, the corneal microscope and the interposition of a convex lens of 20 D. and a focal distance of 16 cm. When the eye is brought close to the optical system, one can plainly observe all the delicate structures of the cornea, the lens and the anterior part of the vitreous. It is also a good way to learn the technic of using the Gullstrand lamp.

Schneider reports a case of pulsating cornea, which he claims is the first on record which was not associated with keratoconus. According to Schneider, pulsations in the living cornea depended upon the following conditions:

(1) Yielding of part of the cornea; the greater the yielding the more marked the pulsation. (2) Size of the yielding surface; the smaller the surface the more marked the pulsation. (3) The relation of the tension between the thinned out part and the normal part; the greater this tension and the thinning, the more marked the pulsation. (4) Intraocular pressure; the nearer the pressure is to normal, the more favorable the conditions for the pulsations.

DIAGNOSIS.—**Suganuma** vitally stained the normal cornea of the rabbit by subconjunctival injection of a 5% solution of lithion-carmin. After hematoxylin staining of the nuclei, the corneal corpuscles showed on microscopic sections numerous very fine equally round carmin granules as far as into the processes.

If this method is combined with intraveneous injections of the staining solution, cornea, episclera and uvea can be simultaneously vitally stained.

If after the vital staining of the cornea, keratitis is produced by cauterization with zinc chlorid or injection of croton oil into the vitreous, Suganuma found, that the inflammatory spears are created by interfibrillar immigrated leucocytes with polymorphous nuclei and klasmatocytes, the regeneration spears by proliferated corneal corpuscles.

Reitsch states that the Biebrich's scarlet red 3% solution has the power of actually coloring ulcerations, and does not infiltrate into other tissues as is the case with fluorescein. The pictures furnished by this method are infinitely more clearly defined, one being able to obtain the coloration of epithelial ruptures, which are not revealed by fluorescein. A double coloration can be used by instilling successively the two stains.

Myashita uses fluorescein to render more distinct superficial lesions of the cornea, where oblique illumination and magnification are not sufficient. He finds that the normal human cornea is not colorable with fluorescein within 60 seconds, while the rabbit's cornea will stain after 10 seconds. The human cornea is stained after three to four minutes, the rabbit's in 30 to 40 seconds.

CORNEAL REGENERATION.—By experimentation on the eyes of guinea pigs, **Wolfrum** and **Boehmig** have attempted to throw some light on the question whether epithelium arises from epithelium, and connective tissue from connective tissue, or epithelium is mainly influential in corneal regeneration. The epithelial proliferation, which took place by direct cell division, represented the first stage of the regeneration. The second stage consisted in the formation of a new layer of tissue between the epithelium and the surface of the incision.

The authors are convinced that in epithelial regeneration only epithelium is active, and in connective tissue only connective tissue cells, presumably derived from the corneal parenchyma. The fixed corneal cells proliferate, by means of direct cell division. The authors have performed a new series of experiments in order to prove that epithelial cells play no part in the regeneration of the corneal basal substance.

The regeneration of Descemet's membrane originates in the endothelial cells. **Kusama** made similar experiments and came to the same conclusions. He further concludes that real scar tissue of the wound develops from spindle cells, which are the keratoblasts of Salzer and which are formed from the permanent cells of the cornea.

The regeneration of simple corneal wounds is divided by **Wolfrum** into two stages. In the first the epithelium plays the principal role closing the opening perhaps in 24 hours. In the second stage the cells of the parenchyma are more important, with wandering leucocytes.

PATHOLOGY.—**Stähli** calls attention to minute drop like appearances on the posterior surfaces of the cornea, which in a previous communication he had ascribed to the accumulation of cells from the aqueous. He now agrees with Vogt's explanation that edematous endothelial cells produce the appearance. In 8 years he had observed a dozen such cases, three of them for five, three and two years respectively. This dew like appearance is always symmetric in the two eyes and always accompanies a mild, chronic conjunctivitis. Three of his patients complained of colored rings around lights, but none had increased tension.

The inoculation of scarified rabbits cornea with saliva from a patient who never had had encephalitis, produced a keratoconjunctivitis and death of the rabbit by encephalitis on the eighth day. The microbes of the saliva, cultivated both anaerobic and aerobic, played no important role in the production of the keratoconjunctivitis. The virus filtered thru a Chamberland filter and inoculated in the same manner, produced a keratoconjunctivitis somewhat less intense than the nonfiltered saliva. This preliminary study was made by **Levaditi, Harvier,** and **Nicolai** to determine the following points: (A) The relation between the salivary virus and that of epidemic encephalitis on one hand, and labial herpes on the other hand. (B) The connection between the virulence of the saliva of certain patients in good health.

The slit lamp has been used by **Burckhardt** and **Koby** to study the lesions produced in the cornea of the rabbit by experimental inoculation with the virus of smallpox. The line of scarrification becomes a chain of foci from 1/7 to 1/2 mm. in diameter, which show a concentric arrangement when examined by light reflected from the iris. **Ungermann** and **Zeulzer** have written on experimental smallpox of the cornea.

Stargardt makes an original investigation as to Vogel's epithelioma contagiosum, and reports inoculations of the corneae of doves, with detailed description of the technic, and clinical and histologic findings. He concludes that the germs inoculated into the cornea generate and lead to the formation of impactions, degeneration and finally to the death of the cells. **Neugebauer** writes on the danger to the eye from puncture of the Gasserian ganglion.

Erosion and Simple Ulcer.—Reporting 6 cases of recurring corneal erosion, **Nocito** finds that the lesion is an herpetiform infiltration. It may occur in different members of the same family; the attacks do not affect both eyes at once, and last about eight or ten days. The interval may be four or five or more months and are somewhat regular. The corneal opacities may arise and diminish the visual acuteness, but no general symptoms are observed. The only treatment suggested is the general treatment of keratitis.

Sannow from experience, gained from 350 cases, with the treatment of corneal affections with $H_2 O_2$ after abrasion, thinks this therapy seems to be indicated in small superficial erosions, inclining to frequent relapses, after slight injuries, marginal keratitis and infiltration of scars, obstinate eczematous keratitis, fascicular keratitis and herpes. It failed in bullous keratitis and corneal ulcers, infected with pus producing microorganisms, especially serpent ulcers.

Tuttle wrote on the symptoms and treatment of corneal ulcers; and **Patterson** and others discussed their treatment.

In order to obtain new iodid, **Hoorens** instills a few drops of a solution of iodid of potassium in the eye and a few minutes later a few drops of oxygenated water. In this way a nascent iodid is formed. In twenty-two cases of corneal ulcer treated in this way, there were only two failures.

In 3 patients, young men, within three years after infection with syphilis, **Battaban** observed a form of bullous keratitis with very small epithelial vesicles forming a circumscribed group with very slight inflammatory reaction and subjective symptoms. There was a little ciliary injection and the sensation of a foreign body under the lid. In all cases the keratitis quickly disappeared under energetic mercurial treatment and the application of an orthoform ointment and occlusive bandage.

Henderson reports two cases of superficial central keratitis in a man and a woman. In each only one eye was affected, and they complained only of diminution of vision. There was no injection. In the woman the opacity cleared up completely. In the man, when first seen, the vision in the right eye was 6/18. There was a fine opacity occupying the center of the cornea, which under the microscope was seen to consist of fine dots and lines under the epithelium, not involving the deeper layers. Two months later the epithelium over the nebula showed marked stippling and vision was reduced to 6/36. This stippling eventually cleared up, but the opacity became more marked; but gradually cleared up and vision is now 6/6.

Neuropathic Keratitis.—A case of neuropathic keratitis, setting in long after alcohol injection into the Gasserian ganglion for relief of trigeminal neuralgia, is reported by **Chance.** The trophic changes did not appear until 2 1/2 years after the injection of alcohol. The corneal manifestations consisted in very extensive desquamation of the corneal epithelium, with the appearance of a cloudy lattice work deposit in the corneal stroma. Several attacks were observed, the epithelial denudation being nearly complete and the restoration remarkably rapid. Tho there were no characteristic herpetic lesions, Chance considers the condition analogous to herpes.

Sturhahn reports a case of neuroparalytic keratitis after injection of alcohol into the Gasserian ganglion, and concludes from a review of the literature, that the use of alcohol injection into the Gasserian ganglion must be limited to only the most severe cases of neuralgia, and that the danger of keratitis may be reduced to a minimum by careful and prolonged after treatment.

Coutela and **Monbrun** describe various conditions with which corneal anesthesia may be associated. Among these are lesions of the trigeminus, neuroparalytic keratitis, ablation of the Gasserian ganglion, fracture of the base of the skull, herpes and keratomalacia. The authors hold that it is the affection of the Gasserian ganglion which produces corneal anesthesia and the symptoms common to herpes.

In a case of *rosacea keratitis* reported by **Groenouw,** the vision was reduced to 1/10 by deep central clouding of the cornea. Under treatment with yellow ointment vision of 1/3 was recovered.

Corneal Herpes.—The results of investigations with regard to corneal herpes are summarized by **Löwenstein.** He finds the virus of febrile herpes shows no special affinity for the nerve trunks of the cornea in the rabbit and cat. In the anterior chamber of the rabbit, the herpes virus produces severe iritic changes followed by depigmented scars of the iris.

Following Löwenstein's experiments, **Kooy** carried out a series of inoculations on rabbits, using the contents of herpetic vesicles. From twenty-five inoculations upon the cornea he succeeded twenty-two times in culturing a polymorphic microorganism belonging to the Mycobacteriaciae. A direct culture from herpes labialis succeeded three times. In animals with general diseased condition, the microorganisms were isolated three times from the blood and spleen. In general, several forms were found in the same culture; at times, pure culture of a special form was observed. The various forms could be demonstrated in smear preparations of conjunctival secretion and corneal infiltration. The organism flourished at 37° C., as well as at room temperature, better aerobe than anaerobe, and was largely Gram-negative. The culture could be transferred by inoculation from one rabbit's cornea to another. **Stocker** inoculated the cornea of rabbits with scrapings from the human cornea affected with herpes febrilis. In all five cases the regular occurrence of keratitis, identical with the human herpes, renders it very probable that the herpes corneæ febrilis is a specific disease caused by a virus. A further proof of its specificity was its transmission from one rabbit to another, always resulting in the typical disease.

Gilbert presents some clinical and anatomic contributions to the knowledge of herpetic eye diseases.

Kraupa presents a short treatise seeking to establish the priority of Grüter's experiments in inoculating rabbits' corneæ with human herpes, as opposed to that claimed by Löwenstein. Kraupa conducted his experiments in 1913 and 1914, Löwenstein in 1914; each working independently but following Grüter. **Luger** and **Lauda** also confirm Grüter's experiments.

Experimenting with the virus of febrile herpes, **Doerr** and **Vöchting** bring out a new fact, that the eye which has not been inoculated shows reaction to the virus in the form of a mild inoculation keratitis with comparatively long period of incubation, which fact would indicate antibodies in the circulation. **Baum** writes on the possibility of transferring herpes simplex to the cornea of the rabbit; **Blanc** and **Caminopetros** take up experimental investigation of herpes.

Rossi reports a case of herpes in a boy of seven, an emotional child who was hypersensitive to adrenalin. The child developed influenzal pneumonia. Punctiform opacities developed into a typical herpes, which covered the cornea. The case is interesting, first because it is the first case of herpes corneae reported in influenza; second on account of its association with signs of the sympatheticotonic type. The writer holds that persons such as this, in whom the sympathetic system is hypersensitive, are especially susceptible to sympathetic instability from intoxications and infections. In this case, the bacterial toxins from influenza were probably responsible.

Harold Gifford uses iodin in the treatment of corneal ulcers especially of the herpetic or dendritic variety. He uses ten or a dozen crystals of iodin in ten to fifteen drops of the ordinary tinctur. Where a less concentrated tinctur is desired, this can be had by adding 5 percent glycerin to the ordinary tinctur.

LeRoux reports two observations of herpes of the cornea following antityphoid vaccination. He quotes Bussy, who states that out of 22,000 men vaccinated, he observed only three cases of corneal herpes. **Ganguly** reports a case of herpes which developed in the course of an attack of erysipelas. **Roelofs** reports a case of herpes with complications, the case being complicated with total oculomotor paralysis, superficial punctate keratitis and herpes of the iris.

Hildesheimer advocates the use of chlorylen in the treatment of corneal herpes. Chlorylen (Kahlbaum) diminishes or abolishes sensibility of the cornea without injuring the eye, even when used extensively. A distinctly favorable influence was observed in inflammatory corneal affections, and cures are reported from chlorylen inhalations. A series of 50 cases were observed, including such conditions as eczematous and herpetic corneal diseases, sickle shaped marginal ulcer and other ulcerations. Photophobia and pain were almost immediately relieved.

CORNEAL LESIONS OF HERPES ZOSTER.—**Reckzeh** describes a case of bilateral herpes zoster. In some cases a toxic affection of the spinal ganglia has seemed to be the cause in the author's opinion.

Junius arrives at the following conclusions in regard to herpes zoster. Various and latent diseases may result in herpes zoster ophthalmicus, respectively as they leave a disposition to nervous disorder, or nervous debility. The traumatic origin of herpes zoster ophthalmicus is questioned. The disease was in one case explained by a disturbance of the center of the trigeminus. Exophthalmos is a rare complication. The possibility is suggested that herpes zoster ophthalmicus and perhaps also ulcus rodens corneae, keratitis neuroparalytica, keratitis disciformis and other corneal diseases of neuropathic origin may all be classed together. The nature of all these diseases is expressed in a decreased vitality of the cornea. The latest publications reject cauterization as a treatment for ulcus rodens and also for corneal necrosis, which are caused by disorders of the central nervous system.

Salterain, in addition to a review of the literature of this rare condition, reports the case of a child of 4 years, girl, who came in a very bad general condition. Had had severe bronchopneumonia, measles and colds. Eight days previously, a blow on the outer, lower orbital margin. Two days later, pain in the left frontal region, followed by redness, edema and swelling of the left upper lid. Eye red, pain, unrest, fever, anorexia, followed by the appearance of vesicles of varying size scattered over the left forehead to the hair margin, and the left face to the ear. The cornea was intact. The left side of the oral cavity was red and swollen, but showed no vesicles. The lymph nodes of the affected side were swollen and painful.

Roelofs reported a case of herpes zoster in a girl 12 years of age, in whose eye washing soda had fallen. The case was complicated by right oculomotor paresis. Recovery of the paresis occurred in a week's time, but the corneal condition continued for months, the later stages presenting the characteristics of superficial punctate keratitis. While the patient was in the hospital other members of the family developed varicella. The author be lieves that this was the cause for the herpes.

Thomas reported a case of herpes zoster in a man fifty-five years of age. The only etiologic factor found was bad teeth.

Isiri reports on six cases of herpes ophthalmia. One was remarkable on account of a tear gland inflammation appearing on the same side as the herpes.

Two cases of ophthalmic zoster are reported by **Eyer** from the Giessen Clinic. One of these in a man of 65 was marked by gangrenous skin lesions, leaving deep scars. Three weeks from the onset, the cornea became anesthetic and clouded with stippling of the surface. Two weeks later the cornea was clearing, but the anesthesia remained the same. At the end of two months a corneal ulcer developed with perforation. The corneal margins remained clear, permitting an optical iridectomy.

The second case, in a man of 74, showed swelling of the lids and conjunctival hyperemia, but the cornea remained clear.

VESICULAR KERATITIS.—**Gradle** describes an unusual case of marginal vesicular keratitis. The epithelium of the cornea, at first a short distance from the limbus, formed a bleb. Disappearance of the bleb, without rupture, was followed by uniform opacity of the underlying cornea, which the author thinks was probably due to toxins of the vesicle contents. The process repeated itself and the opacity increased in size. The cause was not determined. **Masuda** writes on the origin of vesicular keratitis.

KERATITIS SUPERFICIALIS. — **Kraupa** reports four cases of dystrophia epithelialis with pigmentation of the posterior surface of the cornea (Fuchs), two women and two men, all being over fifty years of age and markedly arteriosclerotic. There was considerable decrease of corneal sensibility. Hypertension was absent in all cases, but the author maintains that eventually it will occur. Brown, needle like crystals were present on the posterior corneal surface which glistened in changing light.

Zentmayer reports a case of nodular keratitis in a woman aged sixty-eight years. The corneal opacities were of a greenish gray color. The lesions were immediately beneath the epithelium. The author expressed the belief that the process was probably a dystrophy and doubted a tubercular etiology.

According to **Frenkel**, atropin is contraindicated in superficial keratitis associated with scrofula, impetigo, pannus, granulations, etc. In these cases the drug to use is eserin or pilocarpin. Atropin will not only be of no value, but will actually make the condition worse. In scleritis, depending on the presence of cyclitis or of intraocular tension, atropin can or cannot be used.

PHLYCTENULAR KERATITIS.—Contributions to the pathogenesis of phlyctenular eye inflammations are presented by **Igersheimer** and **Prinz**. The authors first raise the question as to the origin of phlyctenulosis. Is it of bacillary or toxic origin, or simply an immunity reaction?

The authors state that as a general rule, we know that phlyctenulosis shows no tendency to develop into real tuberculosis of the conjunctiva. There are very seldom other tuberculous processes going on in the external or internal eye simultaneously with phlyctenulosis, or even within some time of its development. In 26 cases of eye tuberculosis and in 32 similar cases from the Göttingen Clinic, they found a history of previous eye scrofula in only 6 cases.

The authors' own material of scrofulous eye cases includes 92 patients, who have been followed up for ten, twenty and sometimes even thirty years. In 22 out of 92 patients (23.9 per cent) there were changes in the lungs, and in 12, or 13.0 per cent, there were symptoms of active tuberculosis. One patient died of pulmonary tuberculosis. In 2,144 cases reported between 1911 and 1914, 318 had a history of previous scrofula, while 46 had had scrofulous inflammation of the eyes. Thus 15.1

per cent of patients with previous scrofula, and 17 per cent with previous eye disease showed active pulmonary tuberculosis with positive bacilli findings.

Guillery presents his experimental contributions to the relation between phlyctenulae and tuberculosis. His experiments seem to show that the phlyctenulae should be regarded as a manifestation of tuberculosis without bacilli, created in a tuberculotoxic way, in a specially prepared area. **Steindorff's** paper for the general practitioner deals with phlyctenular and suppurative diseases of the cornea. **Stitzel** has written on "eye ulcers."

Goldschmidt points out the relationship between corneal ulceration and the lack of the fat soluble vitamin, which relationship he believes is established by experimental proof. **Pelayo** has written on grave forms of lymphatic keratoconjunctivitis. **Ganguly** reports good results following the use of thyroid gland in phlyctenular keratitis.

INFECTED CORNEAL ULCER.—**Sanford Gifford** presented a patient showing a central ulcer of the cornea occurring with facial paralysis. Scrapings of the ulcer showed Gramnegative diplobacilli, classed as *Morax-Axenfeld bacilli.* The ulcer was treated with 20 percent zinc sulphat, and the anterior chamber kept open for some time. Proving obstinate to this treatment, one application of the thermophore was resorted to. At present it shows leucoma with a moderate amount of congestion.

Funaithi reports six cases of ulcer of corniea produced by *fluorescens bacilli.* All of the ulcers were at the edge of the corneal pannus. The author suggests that ulcers which often are visible in this location may be due to the fluorescens bacilli.

Birch-Hirschfeld, who has studied and reported upon injurious effects of short wave light, now reports upon its therapeutic use especially for serpent ulcer. He employed a small electric arc lamp concentrating the light upon the eye with a quartz lens, and screening out other rays with uviol glass. The bactericidal action of the light was shown on agar cultures of pneumococcus. In 40 pneumococcus ulcers, only 6 gave unfavorable results, deep extension, perforation, iris prolapse or secondary glaucoma, 2 eyes being enucleated and 2 exenterated. Nine eyes secured vision better than 0.5; eight better than 0.2. The treatment was continued 5 to 7 days in 12 cases, being applied from one to five minutes at a time. The shortest total exposure was nine minutes and the longest 110 minutes, distributed over 27 days. Good results were obtained also in 5 cases of pannus with ulceration and 5 of marginal ulcer, also in 2 of deep keratitis.

Siegrist demonstrated a case of rodent ulcer of the cornea in a woman of 26. After the failure of other treatment, prompt healing was secured by one application of iontophoresis, using a solution of zinc sulphat with a current of 2 m.a. **Asmus** reports zinc iontophoresis in serpent ulcer. **Coppez, Brawley** and **Jocqs** report cases of ulceration of the cornea.

Trerotola describes his clinical and bacteriologic investigation regarding marginal ulceration of the cornea. In 21 cases examined, not including phlyctenular ulcers, he invariably found staphylococcus albus and the massuè bacillus. The author concludes that the etiology of this lesion must be of a multiple nature, and is not due to the presence of one or even of several microbes.

Velarde reports favorable results from corneal paracentesis in infected traumatic injuries of the cornea. **Ganguly** reports a favorable result following canthotomy in a corneal ulcer, associated with trachoma and pannus. In the treatment of corneal ulcers, **Sanderson** emphasizes as most important the building up of the general system. He reports three cases.

Brooks reports good results in the treatment of corneal ulcers from the use of ethylhydrocuprein. **Terrien** reports a case of marginal ectatic dystrophy of the cornea. In this case, and in every case examined, there was neither inflammatory lesions nor cicatrical tissues. Therefore the condition is not a true keratitis.

Barchetti reports keratitis in twins of marked retarded development, enlargement of the spleen and anemia, which was attributed to avitaminosis. Two days after administration of a diet rich in vitamines (cod liver oil and butter) and without any symptomatic treatment, the eyes improved as also the general condition. There was increase in weight, the spleen decreased in size, and the hemoglobin count rose and continued to rise after discontinuance of the cod liver oil.

Gourfein describes a male of 66 years, suffering from ulcus serpens in which, in the anterior chamber, besides the hypopyon, were grayish yellow concretions of cylindrical form, which extended from the ulcer thru the anterior chamber and to the anterior lens capsule. The bacteriologic and experimental investigations led to the conclusion that besides pneumococci, there were also saccharomyces to be found in the secretion from the corneal ulcer.

Butler reports two cases of destructive, sloughing ulcer of cornea. The first case was one of exaggerated *exophthalmic goiter.* The second case was one of disseminated sclerosis in a woman of 36. Both patients died suddenly.

Nogowa observed three cases of marginal superficial keratitis, all having pseudopterygium. The histologic condition is very similar to rodent ulcer. The epithelial layer, the superficial layer of the parenchyma of the cornea and of the conjunctiva are effected. Bowman's membrane is generally destroyed.

MOOREN'S ULCER.—**Feingold** reports a case of Mooren's ulcer of the cornea, in which the eye was removed for relief of pain during the active course of the disease. The eyeball was subjected to careful histologic examinations, and photomicrographs of the sections made are reproduced. No histologic characteristics can be found in the cases so far reported, nor in the present one, to explain why this disease almost always progresses only on the surface of the cornea and only rarely destroys the deepest layers. No etiologic factor could be established in the present instance. **Popovici** also reports on Mooren's ulcer, and **Siegrist** has written on it, and also **Wiedersheim.**

Junius reviews the literature on ulcus corneae rodens and concludes as follows: (1) That it is a primary disease of the cornea. Any relation with episcleritis is doubted. (2) That it develops from infiltration of the cornea. (3) The typical location is the marginal location. A central location has only been observed in one case. (4) There are abortive types which end in recovery.

(5) The disease belongs to the group of corneal diseases of neuropathic origin. This is shown by (a) the injury to the corneal sensibility, which is not however demonstrable in all cases; (b) the injury to ocular tension thru nervous influences; (c) involvement of the ciliary nerve; (d) its relation to other similar diseases of the same group, especially to herpes corneae; (e) from the symptoms that usually accompany peripheral nerve lesions: edema, formation of vesicles and necrosis; (f) the interrupted progress of the disease in the cornea, which is also characteristic of neuropathic corneal diseases.

(6) The cause in some cases lies in the peripheral trigeminus. Neuritic and perineuritic processes may be factors. (7) The cause of individual cases is not always the same. Diseases of the ganglia (G. ciliare and G. Gasseri) are possible. The bilateral disease indicates the more centrally located factor as a cause. (8) Besides bacteria are also found in ulcus corneae rodens. Clinical experience gives no specific origin for it.

ABSCESS OF THE CORNEA.—**Bichon** reports a case of bilateral, symmetric abscess of the cornea in a man of 39, which terminated on one side in panophthalmitis. The condition developed suddenly in the first few days of *pneumonia,* and was undoubtedly metastatic in origin.

Snell reports a case of metastatic ring abscess of cornea in a male, 36 years of age. His entire body was burned by steam. Nine days after the accident, a typical ring ulcer appeared which ran a rapid course to panophthalmitis and complete destruction of the left eye. The right eye also became involved. Carbolic acid was applied to this ulcer, and during the cauterization the membrane of Descemet ruptured, evacuating the anterior chamber. The patient ran a long course of severe general sepsis but finally recovered. The right eye had finally a visual acuity of 20/65. The author believes that the accidental rupture of the cornea was a fortunate occurrence. Of the 22 reported cases of ring abscess, 11 followed accidental wounds of the cornea, 4 occurred after cataract extraction, and 7 have been regarded as metastatic. The case here reported is regarded as metastatic.

Jimenez describes two cases of keratomycosis caused by aspergillus. The first patient presented a yellowish white abscess in the center of the cornea, slight hypopyon, inflamed iris and miosis. The abscess did not open. Microscopic specimens stained with Gram's stain showed the presence of filaments of mycelium. Curetting the lesion was followed by treatment with silver nitrat solution.

The second patient showed chronic dacryocystitis with dacryorrhea, serpiginous ulceration and hypopyon. Paracentesis was performed to drain the hypopyon. Microscopic examination showed scattered filaments of the mycelium of aspergillus.

On examination of the mucous membrane of the upper eyelid, a pseudomembraneous plaque of mycelium was discovered. The mycelian tissue seems to hinder the development of the epithelium and vessels. The lesions in these two cases tended to grow in depth and not in surface extent.

Some variant forms of keratitis are described by **de Schweinitz.** A case is described which is classified as belonging to the group described by Fuchs as keratitis pustuliformis profunda.

THERAPEUTICS OF CORNEAL ULCERS.—**Price** discusses the pathology and treatment of corneal ulcers. For the ulcers of the staphylococcus and streptococcus types, one drachm of *iodoform* to one ounce of castor oil is used. The author's usual procedure is: cocain, then trikresol, or heat cautery, then iodoform, followed by bathing with hot water. Trikresol is an analgesic.

Schwarzkopf has employed *iontophoresis* in the treatment of 27 severe progressive cases of typical ulcus serpens with hypopyon, almost one-half of which were complicated by trachoma. Fourteen cases were adjudged cures, in 3 there was transitory improvement, 1 patient refused treatment because of severe pain, and in 1 case the infiltration was arrested, but necrosis set in and a thick scar resulted. Bacteriologic examination yielded pneumococci (12 cases), diplobacilli (5 cases), and mixed varieties of bacteria (2 cases); in 8 cases the results were negative. The therapeutic results in the pneumococcus cases were apparently more favorable than in those caused by other bacteria. The dosage ranges from 1 to 2 m.a. for two and one-half minutes for large ulcers. Not more than 2 or 3 treatments should be given if no improvement results.

In the treatment of corneal ulcer by iontophoresis, **Schnyder** has devised an adapter which serves as a middle piece between a Pravaz syringe armed with a canula and a hollow needle, and at the same time makes provision for a secure electrical connection.

PARENTERAL INJECTION OF MILK.—**Zimmermann** cites some of the favorable results reported by various observers, and speaks particularly of the very favorable influence of this treatment on the beginning involvement of the cornea in blennorrhea. He reports two cases of his own, one a child 19 months old with probable miliary tuberculosis and phlyctenular keratoconjunctivitis, and another, a girl of six years, affected with corneal infiltrations and severe photophobia and blepharospasm, neither of which responded to ordinary treatment, in which the results following the milk injections were strikingly successful.

Schwarte has treated eight cases of severe suppurative corneal ulcer, three of infected perforation wounds of the eyeball, and two of conjunctival diphtheria. In two of the cases whole milk which had been boiled for three minutes was employed. In the remaining cases a preparation put up by Beiersdorf & Co., of Hamburg was used. This preparation is a milk albumin solution, from which all substances have been extracted which may have irritating effects in parenteral injections.

It was found that a few hours after injection extraordinary improvement in subjective symptoms was manifest, particularly a lessening of the severe pain. At about the same time the increased leucocyte count attained its maximum height. The author emphasizes that in no case was there evidence of local irritation. This is in contrast to other authors who have reported abscess formation of greater or less degree.

Another conspicuously favorable effect of the milk injections on the process of healing consists in the vascularization of the cornea which it encourages. Judging from his experiences, the author maintains that in milk injections a means favorably affecting the disease process has been found, and that its therapeutic use should be encouraged.

Jocqs gives a very brief resumé of the work done in Germany and Austria by Müller and Thanner on the value of milk injections. The author comments on the remarkable results obtained by Domed, of Dijon. In Spain the most ardent advocate of this method of treatment has been Marin Amat, who cites 2 cases of interstitial keratitis in which cure followed eight injections of 2 to 3 c.c. This authority has had similar success with milk injections in cases of postoperative infection.

Jocqs gives his own results in 3 cases, all of which were cured. Suppuration disappeared rapidly, and, in cases of keratitis, the hypopyon disappeared very quickly. The favorable effects of milk injections are observable so soon after the actual injection that, if no improvement occurs after the second or third, the treatment should not be persisted in. The Austrian authorities recommend the injection of quantities up to 10 c.c., but the author believes that from 1 to 5 c.c. are sufficient. The injection is made with a long needle, and is intramuscular. A subconjunctival injection produces the same effect, but in a lesser degree: a pericorneal inflammation sometimes results. The milk should be sterilized at 115° C.

Fernandez records three cases of ocular complications in measles which were very serious. In two, the children were left with suppurative keratitis, which was cured in each case by injections of sterilized cow's milk. **Sirlin** reports a prompt cure of a corneal ulcer with hypopyon and iritis following three intragluteal injections of 10 c.c. of milk, boiled four minutes.

Almeida Huerta reports a case of ocular contusion in which there was retrogression of hypopyon after five intramuscular injections of 10 c.c. of milk.

Gaupillat reports two cases of ulcerated cornea with hypopyon, in which he attempted milk therapy without success. Later he reports three additional cases employing the same treatment without success. **Noceti** reports his experience with milk injections in a case of corneal ulcer with hypopyon. **Aguilera** discusses the treatment of keratitis. He does not advocate the injection of milk but emphasizes that attention be given to vitamins, and **Monesi** writes on mydriatics and miotics in the cure of hypopyon keratitis.

Maruo had better results with miotics than with mydriatics in different diseases of the cornea, especially with ulcus serpens and marasmic ulcerations of the cornea.

In the treatment of herpetic corneal ulcers, **Woodruff** advocates the use of iodin according to the formula of Dr. Talbot.

Krevet discusses the value of conjunctival covering in cases of perforating wounds of the ocular globe and ulcerations of the cornea. The author published 22 observations. The great advantages of this operation have been confirmed by examination of the cases of the Giessen clinic.

Boehmig reports a case of ulcus rodens of the cornea healed by zinc iontophoresis. A once repeated application arrested the process and brought about healing within a few weeks.

Lauber reports three cases of superficial disease in which he used the radium treatment with good results.

MYCOTIC KERATITIS.—In the center of the left cornea of a woman, aged 30, was a striking white spot of from 1 to 1.50 mm. diameter, sharply defined, of finely granulated surface. Under the loup it looked like a fine compressed blossom of 3 leaves. The lower half of the cornea was occupied by an adherent leucoma. The deposit was easily removed with a knife.

After treatment with hydrochloric acid, **Davids** found it consisted of typical glomerulous bodies in form of an actinic wreath, of homogeneous contents. There were no mycelia, and cultures did not grow, showing that these bodies were dead. The bodies must be regarded as a reactive product of the organism. The actinomyces was probably aerobic, as it presented no inclination to grow into depth.

The clinical picture of corneal actinomycosis is very varigated. It does not lodge in the intact cornea according to the experience in actinomycosis of the lacrimal canaliculi, but only after injuries of the cornea. In this case the corneal tissue, changed by disease, offered little resistance to its invasion.

Ashikaga observed in a workman who handled wood shavings, on the lower quadrant of the cornea a white spot which was elevated in the center. With the magnifying glass he observed on the spot three concentric layers, and near to these small greenish dots. In the histologic examination peculiar fungi were found. He believes the fungus to be *Dematium pullulans*. He rubbed the fungi into the denuded cornea, but the inoculation was only successful when the fungi were brought directly into the corneal tissue.

A case of panophthalmitis due to invasion of the *aspergillus fumigatus* is reported by **Castroviejo** and **Munoz Urra,** with an experimental study of the organisms obtained from the enucleated eye. They conclude that colonies of this fungus will develop perfectly not only on the cornea but in any tissue within the eyeball with which the organisms is brought in contact. The pathologic action is undoubtedly due to toxic substances given off during the development of the fungus. The changes produced in the deeper membranes of the eye are due to special degenerations in the cell elements from the great toxicity of the secretion of the hyphomycetes. The toxins cause an intense chemotaxis without the defensive cells seeming to play an important role in the destruction of the colony. The old spore bearing colonies do not take an important part of the extension of the lesion. The end of untreated aspergillus is the destruction of the eye.

CORNEAL LESIONS AFTER INJURY.—**Bedell** discusses traumatic corneal lesions in detail. He points out that gunpowder wounds of the cornea may be treated as ordinary foreign bodies unless the specks are numerous or deeply embedded. In such cases each spot should be touched with the galvanocautery. If the burn be slight or if seen at once, nothing gives greater relief than 10% watery solution of picric acid. The author calls attention to the relation between constitutional and local eye disease existing previous to injury. A patient may have a latent tuberculosis or syphilis which is activated and localized by a trivial accident.

KERATOMALACIA.—In the "Lancet" there appears an article on *keratomalacia* in rats. The article shows that an intimate connection exists between lack of vitamin A in the food and the occurrence of certain nutritive disorders of the eye. From feeding experiments on young rats, keratomalacia occurred only in the absence of vitamin A in the diet. Among 100 rats fed on a diet free from vitamin A, all showed these pathologic eye phenomena, while of other rats fed so as to be but poorly nourished on food containing vitamin A, not a single animal showed keratomalacia. The eye symptoms usually came before there was a decrease in body weight. In all the cases developing the disease, there was hyalinization or necrosis of the outer layers of the corneal epithelium.

Rose describes four cases of nutritional keratomalacia in infants. These are the only cases which occurred in more than 28,000 admissions to the clinic, Children's Department, at Johns Hopkins Hospital. The researches of many physicians are reviewed. In all reported cases, the children had been fed exclusively for a long time on condensed milk. The author points out that in the treament the chief indications are to supply the child with a sufficient quantity of animal fat which contains the soluble A factor. Breast milk is the ideal food; if not available, cow's milk should be used. Cod liver oil should be given immediately.

Kraemer reports a case, as far as he knows the first case published, of keratomalacia in Leiner's disease. He states that those affected by this disease are almost exclusively breast fed infants, i. e., well nourished, well developed infants. The author concludes that the disease is caused by lack of vitamin A, which cannot be produced by the body itself, also that the mother, altho not apparently undernourished may be unable to give the child sufficient vitamin A.

Kleefeld reported two cases of grave keratomalacia, in which subconjunctival injections of a glycerin extract of testicle provoked an intense congestion of the conjunctival and episcleral vessels, followed by chemosis which varied with the dose injected. The injections were used every other day, which produced an active ocular congestion persisting the day after. Of the two cases one presented a perfect cure except that some nebulae remained. The other arising from an ulcer caused by injury from a finger nail resulted in preserving other parts of the cornea.

KERATITIS DISCIFORMIS.—**Junius** believes that from clinical experience there is nothing to hinder the purely endogenous origin of rare cases of keratitis disciformis. Any well defined cold-infection disease is not present in k. d., tho catarrh or colds may eventually produce the disease in certain predisposed individuals. There are also cases in which the only cause, to which the patient feels he may trace the disease, lies in some traumatism. These injuries are, however, usually slight.

The author concludes that in very few cases of keratitis disciformis is the disease really ended after the primary healing of the corneal scar. From clinical observations, we seem thus to be dealing with a nutritional disturbance that is most probably caused by the nervous condition. In the reported cases, herpes iridis was in one case found simultaneous with keratitis disciformis.

All these injuries must, in order to cause keratitis disciformis, have a somewhat continuous effect on the vasomotor nerves of the eyes, i. e., N. trigeminus. There may also be some involvement of the N. sympathicus. Cell injury of the cornea must also be mentioned as a possible cause, and finally also endothelial injury. **Kjølbye** reports disciform keratitis and interesting similar cases of keratitis were reported by **Tiscornia, Xavier, Fernandez,** and **Wisselink.**

Fleck reports disciform keratitis secondary to smallpox. The patient had a foreign body removed a week previous to examination, and several days later the eye became red and painful. About the same time she contracted smallpox. After release from quarantine, treatment of keratitis consisted of atropin and hot application and later dionin. The author thinks that the indications are that disciform keratitis secondary to smallpox is a specific inflammation, probably as specific as the pustule itself. This case is interesting in the variety, its relation to the foreign body and the variola, and the fact that it came before the

State Accident Commission for decision as to compensation.

PARENCHYMATOUS KERATITIS.—Based on the study of hereditary parenchymatous keratitis of luetic origin, **Gilbert** draws the following conclusions: (1) The porcelain-white opacity of the lower half of the cornea is anticipated by an extensive layer of homogeneous connective tissue on the corneal surface, which is here superimposed on the attenuated and denuded membrane of Descemet.

(2) The hyalin degeneration of the pupillary section of the iris (stroma, sphincter, pigment, epithelium), can explain the occasional deficient dilatation of the pupil persisting after parenchymatous keratitis, and is not to be considered as a senile change.

(3) In the posterior part of the eye, the involvement of the choroid should be considered as being primary, that of the retina, with exception of vessel changes, as secondary.

Hoffman asks, "Is there a syphilitic primary effect of the human cornea corresponding to the primary corneal gumma of the rabbit?" The author concludes that a syphilitic primary effect of the cornea exists in the human being, who is certainly more susceptible to the syphilitic virus than the rabbit.

Okazaki implanted small pieces of testicles of rabbits with syphilitic induration. The results were always positive, as the keratitis parenchymatosa developed two weeks to three months after the inoculation.

Nakaizumi describes 18 cases of parenchymatous keratitis, in ten of which he found a fatty infiltration in the parenchyma and also in the epithelial layers. All the cases had chronic conjunctivitis and the secretion contained numerous pneumococci.

Ring describes an unusual case of keratitis in which there was both a positive Wassermann and a positive tuberculin test. Specific treatment failed to modify the condition, but the use of tuberculin brought about almost immediate improvement. The author advocates the simultaneous use of specific treatment and tuberculin in cases of mixed infection.

Macleish reports a case of interstitial keratitis occurring in a child three years of age, which presented a typical picture of malnutrition. Wassermann negative. There were no ulcerations or phlytenules. The child was allowed to eat an excessive amount of sugar. Two weeks after the withholding of all sugar, the eye showed remarkable improvement, a complete cure occurring in about one month's time. A year later the child was again allowed to use sugar in excess. The keratitis recurred. Following the withdrawal of sugar a second time, the keratitis cleared up promptly.

Weekers reports a case of typical interstitial keratitis with characteristic symptoms occurring after superficial injury to the cornea. Wassermann was negative and there were no clinical signs or symptoms of syphilis.

Blaxland presented a case of interstitial keratitis, a young girl seventeen years of age, in which both tubercular and Wassermann tests were negative. Of **Uhthoff's** 200 cases, 156 were of luetic origin, 7 were tuberculous and 37 of uncertain etiology. Of the latter 18 were only seen once and no Wassermann test was made. In age, 187 patients were under 30 years, 9 between 30 and 40 and 4 over 40. Specific treatment for lues or tuberculosis is most important.

Rönne reports two cases of nonsyphilitic keratitis associated with arthritis. **Cameron** reports a case of *sclerosing keratitis* in a woman twenty-five years of age, in which the family history was negative, tuberculin and Wassermann tests, tonsils and sinuses negative. Three suspicious teeth were extracted. **Shimizu** reports two cases of parenchymatous keratitis following trachoma.

The efficacy of *salvarsan* therapy in parenchymatous keratitis and on the acuity of vision was tested by **Uhthoff** in 200 cases, 90% were of luetic origin, 3 1/2% were tubercular and the rest undeterminable. The luetic cases were treated with mercury or combined methods, and the tuberculous cases with tuberculin. Locally, atropin, dionin salve, and heat were used. No difference was seen in the cases treated with inunctions and those with combined treatment. Salvarsan does not influence the disease.

Bussy and **Japiot** have found *radiotherapy* invaluable in treating cases of interstitial keratitis. Two case reports are given, in which the writers record excellent results with feeble doses of the X-ray. However, they admit that all cases of parenchymatous keratitis are not cured or improved so easily. The cases of heredospecific keratitis appear to yield to treatment more easily than any others. The writers have further found that the rays have more effect in the inflammatory forms with violent congestion and intense subjective phenomena than in the torpid forms; the younger the subject the more effective the rays. The penetrating rays are obtained by using an aluminum filter 3 mm. thick. The treatments are given in a series of five, a week apart, each treatment lasting five minutes.

Shields presented a boy aged 18 who for the past 8 years had had interstitial keratitis of one or both eyes. Both corneas show triangular areas of opacity. In each eye there was marked posterior synechia, but in the right eye this had given way under atropin and dionin. At the age of 10 the patient had suffered from inflammatory rheumatism. A negative Wassermann had been obtained, but the presence of syphilis was supported by Hutchinson teeth and deafness. Antisyphilitic treatment was being used.

Ellett reports the case of a boy, aged 14, with interstitial keratitis. Both corneas were quite opaque. Vision 20/50 and 10/200. General treatment was advised but not followed.

Rosica maintains that not only from the scientific but also from the medicolegal standpoint, it is very important to find out the etiology of parenchymatous keratitis. In the study of 100 cases, 80% presented hereditary syphilis as the cause. In only two cases was trauma the only causal factor. In many cases, the trauma is considered a mere accident, but in the atypical forms, trauma may represent the determining cause, the trauma being considered the provocative element.

Hagop Alyanakian maintains that interstitial keratitis, altho a dyscrasic affection most frequently connected with hereditary syphilis, in most cases requires a determinant cause to show itself. Among these determinant causes are acute infectious diseases, chronic cachetic diseases, eruptive fevers, overwork, general fatigue, inflammation of the cornea and traumatic lesions of the eye.

Geis reports a case of acute parenchymatous keratitis complicating epidemic parotitis. Pure parenchymatous keratitis (without iridocyclitis) as a complication of *mumps* is quite rare. The author has seen one such case in a ten year old girl. The corneal epithelium was diffusely "spotted." The parenchyma of the middle portion of the cornea could be seen with the naked eye uniformly dull in its deepest layers; this dull appearance, however, was more intense in the very center of the cornea. Geis believes that the parotitis toxin was the causative agent of the keratitis. Of interest are, the isolated keratitis, its sudden onset, and its acute course with recovery after six days.

Seibert reports favorably the use of salvarsanized serum in the treatment of ocular syphilis by subconjunctival injections, and in keratitis by dropping the serum into the conjunctival sac.

TUBERCULOUS KERATITIS.—**Lewis** and **Montgomery** describe their conclusions from experiments made on rabbits, using a culture of bovine type. They describe the development of the corneal lesions and the influence of virulence of culture. The authors agree with those who have held that *tuberculosis* is primarily an exudative inflammation and secondarily proliferative in its character, and that the cellular exudate, protective tho it may be in purpose, is defective and is destructive in its actual influence.

Two cases of parenchymatous keratitis are reported by **Hessbrügge.** In the first, the patient claimed that while he was working on a die 3 days before, something struck his eye. The examination showed no trace of injury. On the grounds of the ophthalmologic examination, the court decided that it was more likely that the patient had a beginning keratitis to which the accident called his attention than that the foreign body had evoked a keratitis in a syphilitic patient. In the second case coal dust was forcibly blown into the patient's eyes. Three months later, the patient presented himself with a monocular keratitis, which later appeared in the other eye also. A decision similar to that of the first case was rendered.

Guzman reports a case of epibulbar tuberculosis in a man of 28, suffering from pulmonary lesions and pleurisy. There had been change in the appearance of the lesions in 4 weeks.

Weeks reported a case of keratitis in the left eye of a man 52 years of age. Generalized tuberculosis and other infections were excluded. The patient had a local and marked focal reaction to 1/1,000 mg. of old tuberculin. The cornea cleared rapidly after the administration of small doses of O. T. injected subcutaneously.

Simon de Guilleuma reports a case of interstitial tuberculous keratitis occurring in a man, aged 35, which was cured in a few months by 11 injections of vaccine of Dr. Ferran. **Sanchez Gardel** has written on tuberculin in keratitis and **Pons Marquez** also reports a cure of tubercular keratitis from the use of *tuberculin.* As ophthalmologist at Finsen's institute in Copenhagen, **Lundsgaard** has had more than six years' experience with *phototherapy* in the treatment of diseases of the eye, especially tuberculous diseases. The carbon arc light was used exclusively. Within the last three years about 200 patients, some with diseases of the eye alone, others with ocular complications of lupus and surgical tuberculosis, have been subjected to general treatment by light. The category of disease embraces phlyctenular keratoconjunctivitis, tuberculous keratitis, scleritis, lacrimal diseases, chronic iritis, and iridocyclitis. The results obtained demonstrate that general light baths are of little importance in the treatment of diseases of the eye.

KERATITIS IN ANIMALS. — **Heusser** has studied the opacities and vascular development in the cornea of the horse. Near the corneal margin he found anterior synechia in a case of round central nebulae, there was a defect in Descemet's membrane, and a traumatic band clouding a rupture of that membrane. In a marginal clouding, in addition to the anterior synechia, there was connective tissue of endothelial origin. In opacity due to detachment of the endothelium, a thin new formed glass membrane was found. Leucoma due to perforating wound showed great thinning of the propria, vascularization and rupture of Descemet's membrane. Much the same conditions were found in leucoma. In the clouding of recurring ophthalmia of horses, grill like opacities were found. Pigment deposits on Descemet's membrane along the new formed tissue are also described. The most striking forms of vascularization were those in which many fine or larger vessels ran in from the limbus, and in one case of injury by cauterization with silver nitrat a complete circle or oval of vessels was formed half way between the corneal margin and the center. Where vessels were rapidly developing, streams of blood cells seemed to extend into the corneal tissue beyond the extremities of the vessel walls, with wandering endothelial cells advancing with them.

Triebenstein found in the eye of a cow affected with infectious keratitis the whole posterior surface of the cornea devoid of endothelium. In the nasal and temporal sinuses of the anterior chamber were thick pigment lumps, in which bands of cells lay spirally rolled corresponding to the detached endothelium of the cornea. Some of these bands were still in connection with the cells of Descemet's membrane. The simultaneous anterior capsular cataract suggested a disturbance of development.

KERATITIS PROFUNDA.—A rare and hitherto undescribed case of postinfluenzal keratitis profunda has been observed by **Hartmann**. It was unilateral and characterized by a deep, centrally placed, discoid infiltration which, after suppurating, perforated thru the external surface of the cornea. Iritis was present with hypopyon.

Lewis reports a case of sclerosing keratitis in a woman aged fifty-three, occurring first in the right eye and eight months later in the left eye. Examinations of tonsils, teeth, sinuses, Wassermann were all negative. **Snell** reports a case in a woman of 68, extending until two-thirds of the cornea was opaque.

LEPROSY.—**Arisawa** reported a case of leprosy with opaqueness of the cornea and at the outer limbus a leprous tubercle. Extirpation of this tubercle cleared up the cornea. The author found in the tubercle a granuloma which passed from the muscular layers of the ciliary body to the sclera, more easily demonstrated in the ciliary body. The clearing up of the cornea resulted probably from removal of the focus and general treatment.

Strader reports sclerosing keratitis in woman, aged 28, whose right eye had been inflamed at intervals for five years, usually during the hot weather. There was marginal involvement of the cornea and a hair like opacity toward the pupil, which did not stain. The family history was negative. The condition seemed to agree with Fuchs' description of sclerosing keratitis.

PERIODIC OPHTHALMIA IN HORSES.—This disease involves the uveal tract, but attracts attention by the symptoms of interstitial keratitis. **Post** reports studies regarding its etiology, including experiments that seem to exclude ordinary contagion, and failures to isolate any microorganism that would cause the disease, and failure to produce the disease by inoculating the healthy eye of a horse with iris tissue and aqueous from eyes affected with the disease.

CORNEAL DEGENERATIONS.—**Kusama** reports a case of primary *fatty degeneration* of the cornea in the left eye of a woman of fifty-five years. On the middle portion of the cornea there was a dense parenchymatous, discoid, thick yellowish-white opacity. Vision: fingers. Wassermann negative. Where the disease condition had advanced extensively, there was absolutely no trace of Bowmann's membrane and the basal cells rested directly upon the parenchyma. In the diseased corneal parenchyma, the lamellae were seen in glassy swellings, or fallen into small pieces, between them numbers of corneal bodies and a few leucocytes. In addition to these findings, stained preparations (Sudan III) showed yellowish-red fat substances, in the lamellae and not between them. Chemical tests showed cholesterin, fat and acid.

Coppez presents a case of *annular dystrophy* of the two corneas in a male, aged forty. On the cornea there was an opaque grayish ring, whose external border was concentric with the corneal margin, from which it was separated by a band of normal tissue about 1 mm. wide. The inner edge corresponded to the pupillary border. Upon examination with Gullstrand's lamp, the opaque ring was seen to be composed of numberless small mirror like crystals. In the center of the corneas, which appeared normal on superficial examination, similar crystals could be seen. There was no vascularization. The writer believes that this was a case of degenerative process of unknown etiology.

Kraupa reports 4 cases of peculiar slight grey opacities of the parenchyma of the cornea, visible only with the binocular microscope, and not impairing vision, in patients affected with *ichthyosis* of the skin. They resembled family degeneration diseases of the cornea, but differed from them in that impairment of vision by progression of the opacities could not be ascertained. The changes must be regarded as trophic disturbances, such as probably occur under the epithelium of the skin.

Behmann observed in a boy, aged 12, and a girl, aged 6, a transverse, whitish grey *ribbon shaped opacity* with seclusion of pupil and organized exudations in the pupillary area. Iridectomy in the second case cleared the opacity considerably. There was no other etiologic factor except malnutrition. The author contends that, as the iritis with the synechiae is to be considered as the cause of the corneal degeneration and the opacity as the consequence of disturbance of nutrition thru the impeded flow of the aqueous, iridectomy seems to be fully justified, especially for prevention of secondary glaucoma.

Three families who had *family degeneration* of the cornea running through three degenerations were described by **Tritscheller** in a dissertation in 1910. A fourth family has been found with the same inherited condition and a common ancestor of the four families has been located six generations back. The family tree of this fourth family is given. The disease occurred chiefly in the male members of three of the families and was transmitted thru the male line. In the first family only females were affected. In the third family only two generations were affected, but the children of the third generation are only one to six years old. Three generations have the disease in the fourth family. The form of degeneration is the same in all the families: in all the layers of the cornea there were fine, crystalline, irregularly shaped opacities.

Osaki describes 11 cases of a peculiar, lattice like keratitis. Histologically the author found an edematous epithelial swelling: cause unknown.

Lamb reports a case of *keloid* of the cornea in a girl six years of age. There was a total staphyloma of each cornea. A prominent, opaque growth covered almost the entire surface of the left cornea, appearing as a flat cone, projecting forward four millimeters from the anterior corneal surface. Tension in each eyeball was three plus and vision nil. The author regards his case as one of typical keloid, which he differentiates from the usual cases of fibroma.

Jewesbury and **Spence** report a case of deformity of the skull, with bone changes and corneal opacities. This was a case of congenital acrocephaly.

Uhthoff reports clinically and anatomically 4 unusual cases of degenerative changes of the cornea: (1) A case of dystrophia corneae epithelialis in a 70 year old woman. (2) Chronic deep circumscribed keratitis in a 34 year old woman. (3) Left sided deep circumscribed keratitis in a 47 year old woman. (4) Bilateral and quite symmetric degeneration of the cornea without evidence of an actual inflammatory process, in a 56 year old woman.

A contribution to the study of Haab's bands is presented by **Guist.** He describes a case of congenital hydrophthalmus in which Haab's bands were very marked. At the age of two years, a band of 3 mm. width was discovered in the right eye and in the left a dull cornea. Sclerectomy and iridectomy. Ten years later glaucomatous symptoms.

Junius writes on spontaneous anterior synechia. He draws the following conclusions after giving seven case reports: 1. In the course of chronic uveitis, complete drying up of the aqueous humor may take place. 2. As a result, complete disorganization of the anterior chamber ensues. 3. In this condition, adhesions may form between the anterior iris and the posterior cornea.

Zaky describes a case of postoperative striae of cornea, which he thinks is partly due to cocain.

FISTULA OF CORNEA.—**Sattler** reports a very unusual case of *fistula* of the cornea, apparently due to perforation by a partly calcified lens. The subject of this report was a 42 year old woman who, at the age of 14, while chopping wood, injured her left eye so that it became totally blind. There were no inflammatory manifestations and no pains until 28 years later when, without any external cause, the same eye suddenly became very red and extremely painful. Sattler found the sharp edge of a small, calcified, irregularly formed lens lying within a perforated opening in the cornea. There were no signs of recent abscess formation or injury.

Gradle believes that subconjunctival corneoscleral fistula is a much desired end result in certain operations for glaucoma and the possible danger of late infection may be neglected, but in young individuals, who carry such a cicatrix as a result of trauma, the danger of infection thru the filtering fistula is an unnecessary risk. The author reports two cases of such fistulae resulting from injuries, where he was able to close the opening by simply raising a conjunctival flap and inserting a suture. In one case he succeeded in replacing the iris that was entangled in the wound scar, and produced a round pupil.

OPACITIES.—**Lortat-Jacob** and **Trubin** prefer to call the *senile arc* the corneal circle, as it is not a sign of old age but only of a general tendency to sclerosis. In 30 tuberculous cases, some of the patients were from 35 to 45 years old. The senile arc occurs predominently in men. **Rijkens** has written on the entoptic picture and stenopaic glasses in corneal opacities.

Majewski describes a case of total *ankyloblepharon* with precorneal cyst, a female patient, aged fifty-eight years. Operation with transplantation of rabbit's conjunctiva was partially successful, tho the cornea remained dull, so that only hand movements were distinguished. The left eye finally gave a corrected vision of 6/18. The affection was due to luetic ulceration.

McKeown presented a woman, aged 23, whose cornea was highly staphylomatous, there being nearly 5 mm. of protrusion. The eye had suffered injury at 16 years of age, the iris prolapsing. Four years after the injury an operation had been done on the eye, the nature of which was uncertain. The patient complained of pain, vision was reduced to light perception, and the surface of the cornea was generally hazy. The posterior segment of the eyeball was normal.

Seefelder examined the eyes of a dog, aged 4 weeks, with extensive central opacity of the cornea. The case was an instance of typical congenital defect of Descemet's membrane and the posterior layers of the cornea, as described by Peters.

Griscom presented a colored woman, aged 60, complaining of failing vision. There was a dense white band composed of irregular masses of calcareous material located just beneath the epithelium, five mm. in width, and horizontally across the cornea. The patient stated that vision began to fail after an attack of influenza two years previously. Vision 20/200.

PIGMENTATION. — **Meesmann** described two cases of pigmentation of the corneal limbus in Addison's disease, the first in a man aged 31. The corneal limbus of both eyes was of brownish black color in a width of 2 mm. extending over the cornea. This ring consisted, as shown under the corneal microscope and slit lamp, of distinct dots arranged in single complexes, which the writer thinks corresponded to single epithelial cells. The surface of the epithelium appeared intact, the pigment occupying the deeper strata. Towards the periphery a system of radial cylindrical canals of lymphatic vessels were visible. The author concludes that the abnormal pigmentation in the eye may be due to a disturbed function of the suprarenal glands.

Supporting his argument by detailed histologic description of his three reported cases of blood pigmentation of the cornea and a careful analysis of the conclusions of other investigators, **Wirths** draws attention to the possible connection between corneal pigmentation and connective tissue formation. In the author's three cases, a fibrinous connective tissue layer, showing spindle shaped nuclei, developed in the anterior chamber. Examination of cases of hemophthalmus without corneal pigmentation did not show this connective tissue web, which makes it an obvious fact that hemorrhage per se is not the exciting factor in the tissue formation.

HEMORRHAGE.—**Shigeta** reports corneal hemorrhage in glioma of the retina. This rare complication has given the author the opportunity to examine minutely with Heidenhain-Eisenalaum-Hematoxylin stain. With it he was able not only to see the bodies or granules in the cornea, but also within the blood corpuscles which were present in the blood in the anterior chamber. He believes with Matzuoka that these particular granules have entered the corneal tissue, but he does not give their character. **Hertz** has reported on hemorrhage into the cornea.

KERATOCONUS.—**Montaño** had a patient of fifty, who had such an extreme case of keratoconus, that she could see only indistinctly and could not be corrected with any lens. He operated by Elliot's method of trephining. The fourth day after this operation the cornea was very much flattened. Lenses were prescribed and a year after the operation the patient saw well with the same lenses. **Wernicke** suggests that multiple sclerosis is the best etiologic explanation for keratoconus and also for glaucoma. **Altube** has written on the etiology of keratoconus.

Stock describes the correction of conical cornea thru improved ground contact lenses: (1) The contact lens now consists of a sclerotic and a corneal part. The sclerotic part must be broad enough (about 6 mm.) so that the upward glance may not cause the edge of the lower lid to be caught by it. (2) The outer edge, and particularly the transition from the sclerotic to the corneal parts, is so rounded off, that no irritation of the eye is possible. (3) Any desired refraction may be given the corneal part.

Mendoza reports improvement of a case of keratoconus by the application of his apparatus over a long period of time. In three months, the vision had improved from 0.1 to 0.5. The apparatus is a plaster of paris cast of the eye lids and is held in place by a bandage which exerts a slight pressure.

Smith reported a case of bilateral conical cornea in a woman aged 29, in excellent general health. Vision, however, had begun to fail at 16. Vision now is right, 6/60, left 6/20. Deformity of the cornea is quite marked. Treatment consists of a weak solution of eserin salicylat as a possible aid to drainage.

Takagi and **Yoshida** report on a case of keratoconus where there appeared to be no physical disability in the patient, but examination of the blood showed an increase of white corpuscles and lymphocytes, and a vagotonus could be demonstrated in the sympathetic nervous system.

Siegrist presented 2 boys of 17 years with typical keratoconus in both eyes. The one was a cretin with atrophy of the thyroid, the other a Mongolian idiot. With a contact glass vision was improved from 1/10 to 6/10.

Staehli answers the criticisms of Clausen of his articles on keratoconus, and again enumerates his arguments that the brown horizontal line and the keratoconus ring are of the same nature; viz, dust deposits of pigment from the lacrimal fluid, of extraocular source, and not as Clausen assumes, due to blood from vessels in the cornea, as there are pigmented macular corneae where blood vessels or their remnants cannot be detected by modern methods of examination. The fact that the pigment lies in the epithelium speaks very much against intraocular origin.

MEGALOCORNEA.—**Hooker** describes a case of megalocornea in a man of 59, the cornea having a diameter of 14 mm. All his brothers (not sisters) had big eyes. He had a cloudy lens which was operated with very good results. Two types of this condition are described. (1) A mild form involving only a portion of the eye and not necessarily associated with glaucoma. (2) A malignant form which sooner or later becomes associated with glaucoma. Only those cases having good vision and showing no signs of hypertension should be operated upon.

Salmon reports a case of megalocornea on which he operated for cataract. Only three cases of megalocornea have previously been operated on for cataract. In the twelve day old case, **Poyales** reports microphthalmia associated with incomplete coloboma involving the left lower lid and continuing to the lip in a scar parallel to the nose. The microphthalmia, the author maintains, was due to a prenatal keratitis caused by the amniotic cord becoming attached to the cornea.

Brazeau reports a case of circumscribed ectasia of the cornea. **Kyrieleis** reports a case of peripheral furrow formation and peripheral keratectasia in a man of 56, due to undernourishment during the war. With physical changes due to better nourishment, the ectasia disappeared.

Reis reports two cases. In both, cataracts were removed. By exact measurement, the author found that the thickness of the lens in no wise differed from cataracts removed from normal individuals. He believes that megalocornea is an isolated morbid process.

Kleinsasser reports a case of true megalocornea in a child of eleven years. Tension normal. Diameter of cornea in both eyes 15.5 millimeters. Anterior chamber very deep, iris trembling, remains of fetal pupillary membrane. Pronounced diminution of the sensibility of the cornea.

OPERATIONS ON CORNEA.—For *tattooing the cornea,* candle soot obtained by holding a microscopic slide over the flame of a candle is used by **Blaskovics.** The histologic examination of a tattooed eye showed thickened degenerated epithelium replaced by normal epithelium. A great mass of soot granules were in the scar tissue, some in corneal corpuscles or fixed connective tissue cells, lymphoid cells and some vascular walls. There was no cellular infiltration, demonstrating the lack of reactions. **Wiener** has tried this method with excellent results. The area is outlined with a trephine and denuded of epithelium, and 4 or 5 scarifications made obliquely in two directions. **Asmus** employed with very good results in 2 cases of clear cornea and in 1 with partial opacity, the tattooing method of Hesse to cover a disfiguring complicated cataract. A flap of the cornea marked with von Hippel's trephine is dissected and the India ink placed under it.

Blaskovics describes his operation for corneal staphyloma. If a small part of the corneal border remains, the staphyloma should be removed and the wound covered with conjunctiva after Kuhnt. Thick walled, hard staphylomata and intercalary staphylomata are to be completely removed; and for solid covering, the suture should be placed in two layers. He puts a catgut suture thru the individual, severed muscles and the capsule of Tenon, and by drawing this causes the staphylomatous ball to recede. The conjunctiva is sewed over this. In high degrees of total ectasia, Weeks' method can be used. All these methods are to be used only if there is light perception, on account of the danger of expulsive hemorrhage. In the latter case, evisceration with fat implantation or Sondermann's operation are adapted. In equatorial staphylomata, only enucleation, with or without fat implantation, can be used.

Gradle discusses the present status of *keratoplasty* and groups all the different forms of operation which have been devised into five types.

1st. von Hippel's trephine operation, involving part of the corneal thickness in the area removed and transplanted.

2nd. The complete keratoplasty of von Hippel.

3rd. The ribbon lamellar type of Loehlein.

4th. The denuding operation of Wiener.

5th. Kraupa's keratoplasty.

The author reports a case operated on according to the last method, which consists in the rotation of a trephine flap of cornea so that a clear portion of the cornea may be placed centrally and the opaque portion in a more peripheral position. In the author's case the corneal transplant successfully united; but vision was not improved, due to the fact that some of the deeper opacity was not removed and also because optic atrophy was present.

Burke presents a brief review of the literature of transplantation of the cornea and adds the histories of two cases operated upon by himself. His method consists in the removal of the entire cornea, with a ring of conjunctiva, and the insertion of another obtained from some patient who has a perfect cornea in an eye lost from injury. Healing of the transplanted cornea was accomplished, but in both cases light perception was the best vision obtained, and one developed glaucoma a few years later.

Differences are noted by **Fleischer** in the reaction about auto- and homoiotransplantations of iris and cornea. These seem to be a matter of degree and not of quality. The writer believes that epithelial tissues do not attract lymphocytes as does the connective tissue, and furthermore that it appears that neither fibroblasts nor lymphocytes attack epithelium as readily as they attack connective tissue.

Tenner describes the technic of his operation of staphylectomy for the correction of partial or total staphyloma. The end results arrived at are twofold. The removal of the deformity and the improvement of sight. The latter is gained by an iridectomy, usually performed some time after the primary operation. The further object sought is the obtaining of a moving stump over which a prothesis may be worn. For this purpose the author believes that the operation of staphylectomy gives better results than evisceration. The author lays stress on the fact that all scar tissue should be removed, and that the sutures should be inserted into healthy tissue. The removal of all possible sources of infection should be cleared up prior to performing staphylectomy. The operation is performed under a general anesthesia. The author has performed 18 staphylectomies: In two with total staphyloma, vitreous was lost. The technic of the operation is described.

Jacobi reports the clinical histories of 2 cases of staphyloma of the cornea after injuries, in which he supported, according to Kuhnt's method, the pedunculated conjunctival flap in the first case by fascia lata, and in the second case a transplanted piece of mucous membrane from the lower lip, with good keratoplastic results.

The results of complete homotransplantation of the cornea are described by **Ebeling** and **Carrel.** They maintain that if this operation be performed under proper conditions, the transplanted fragments can remain transparent, and the curvatures of the cornea normal. The experiments were performed on cats. The result of the experiment shows that the technic which was used allows a perfect restoration of the cornea, even when a very large segment has been resected.

Contributions to keratoplasty are presented by **Salzer.** As a result of his experiments, he asserts that the individual life of the transplant in corneal transplantation plays a part of small or temporary significance. Total keratoplasty in adherent leucoma cannot possibly have optic results, while partial keratoplasty may. Transplantation of the cornea with function and vitality intact in the transplant is possible, in mammals and human beings, only by autotransplantation.

THE SCLERA.

DIGEST OF THE LITERATURE.

PIGMENTATION.—**Matzuoka** writes on the distribution of the pigment in the pericorneal region, with a contribution to the knowledge of Manz's glands.

BLUE SCLERAS.—**Blegvad** and **Haxthausen** report blue sclerotics and zonular cataract. They have compiled from their records a number of families in which 76 of the 156 members had blue sclerotics, and 24 of the 52 who had their bones examined displayed a tendency to spontaneous fracture. They describe one family where the blue sclerotics were noted in three generations in 10 of the 23 members and all those affected, except the grandparent, had fragile bones. One young woman presented in addition a zonular cataract, a peculiar skin affection resembling atrophy, and she had suffered nine fractures from very slight trauma.

Freytag describes a case of blue sclera and fragility of the bones, in which these two anomalies ran thru four generations; there was also abnormal pliability of the joint ligaments and capsules. Of 18 members of the family in five generations, 11 had blue scleras and fragile bones, 9 defective hearing. The family tree is shown. The anomaly was transmitted directly to individuals of either the same or of the opposite sex. A case of a boy with very brittle bones is reported by **Van der Veer** and **Dickinson.** His scleras seemed normal but his elder sister had blue scleras, but no fractures, while four younger sisters and a brother had normal eyes and bones.

SCLERITIS.—**Collomb** describes a case of *tuberculosis* of the sclera. The patient gave a history of both syphilis and tuberculosis. Therefore a small white tumor in the episclera near the limbus was first treated for syphilis, but as it continued to grow, a piece was excised and implanted into the anterior chamber of a rabbit, which developed a typical tuberculous iritis, altho the tumor itself showed no bacilli. The nodule was cureted thoroly, and the iris prolapse was excised, followed by cure. The literature is reviewed.

Friede describes a congenital serous *cyst* of the sclera and **Meisner** reports a case of exudativum multiforme with involvement of the sclera. **Bachstez** reports a case of metastatic suppurative *episcleritis* which developed after a goiter operation, and which was due to a staphylococcus sepsis. Only three similar cases are reported in the literature. **Uhthoff** demonstrated the specimens from a case of gelatinous keratitis, which affected both eyes of a man of 70 years involving the deeper structures, and lead to enucleation for secondary glaucoma.

Mazumoto describes a case of suppurative scleritis and presents the histologic findings in a man forty-eight years of age, who had also a fibromatous tumor of the orbit. The eye was enucleated on account of panophthalmitis. Histologically the affected area in the sclera showed suppurative *necrosis* with suppurative infiltration of the other tissues, probably caused by gingivitis. The patient died from a purulent basal meningitis. The writer could find in the literature only 10 cases in which a purulent scleritis was examined histologically.

Kramer describes a case of metastatic furuncular episcleritis in a young man of 22. After suffering for about three months from skin furunculosis a suppurative episcleritis developed at the corneal border. There was no involvement of the iris, showing that only the superficial layers of the sclera were affected. Eighteen cases are collected from the literature. Staphylococcus pyogenes aureus was the cause in all the cases. Bacteria can generally not be demonstrated in blood.

A case of nodular episcleritis, occurring in a Jewish woman, aged thirty-six, is reported by **Sinsky, Levin** and **Sacks.** The following is their summary of the case: A case of episcleritis resisting the usual forms of treatment is presented, and is concluded to be of metabolic origin. After omission from the patient's diet of carbohydrates, in the form of cereals, potato, bread, and sugar, and reduction of the intake of fat, a disappearance of symptoms resulted. That the relation of the ingestion of certain foods to the ocular condition is not an accidental one is evident from the fact that the patient's symptoms can be experimentally reproduced by the ingestion of the offending foods. It is suggested that in the diagnostic study and therapy of cases of episcleritis of obscure etiology, dietetic factors be taken into consideration.

Velter and **Monbrun** call attention to the part played in old inflammatory lesions that render the sclera friable. They present three patients. **Asanuma** reports gliomatous scleritis.

Anterior Chamber and Pupil

WILLIAM R. MURRAY, M.D.

MINNEAPOLIS, MINN.

This section reviews the literature from March, 1921, to March, 1922. Its literature frequently overlaps that of the uveal tract, and sometimes that of the visual tracts and centers. For previous literature see Ophthalmic Literature, 1921, v. 17, p. 131.

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DIGEST OF THE LITERATURE.

ANTERIOR CHAMBER.—**Kubik** first discusses the *anatomy* of the anterior chamber in the eye of the horse, and refers to the fact that Virchow has divided the tissue of the anterior chamber into an uveal and sclerotic stroma. In man, as is shown in preparations, a large residue of this uveal stroma occurs and may be observed in vivo with Gullstrand's apparatus. This fact throws light upon the change in Schlemm's canal which is probably a significant factor in the glaucoma question. The scleral stroma in man is found to be covered with many fine specks of pigment, and with pigment granules. An eye is shown in which Schlemm's canal is missing.

Vogt has found that the use of the slit lamp microscope has rendered the diagnosis of obliteration, partial or complete, of the anterior chamber a certainty. He also combines this method with oculomicrometry in measuring the distance relations between pupillary fibers and membranes, and between the lens and posterior corneal surface.

Leboucq endeavors to show the real existence of a *circulation* in the anterior chamber. He says that it suffices that the intravascular pressure be elevated in the eye, or that the extravascular pressure be lowered in order that the liquid of the anterior chamber changing its normal composition, should resemble lymph. From this he concludes: "The facility with which the aqueous humor varies in its composition and then returns to normal, is the best proof that the anterior chamber is traversed by a circulating fluid." He finds the anatomic proofs of this circulation in the lymphatic spaces crossing the scleral shell around the anterior ciliary veins, giving free passage to substances introduced in the anterior chamber.

For the physiologic demonstration, he describes the following experiment: Tie the superficial and deep lymphatics of a rabbit at the base of the neck (which will cause a myosis, perhaps by reflex excitation of the ciliary ganglion). Two hours later, inject into a vein of the ear 2 to 3 cm. of 1/10 uranin. After two minutes, a green spot of fluorescein, derived from the uranin, appears at the same time in both eyes, at the upper edges of the pupils. It gets larger and goes downward, forming a green path, which remains and diffusely colors the aqueous humor on the normal side, while on the tied side it remains very limited. Leboucq believes these lines of Ehrlich act just as tho they formed, the former in stagnant water, the latter in water not so stagnant.

Then other lines form successively, and at the end of fifteen minutes both eyes are entirely fluorescent. But at the end of half an hour a dark spot appears at the lower part of each pupil, and gradually rises, leaving a dark trail, negative Ehrlich line, due to the reappearance of the normal aqueous humor.

The two anterior chambers slowly become lighter in color, and this decoloration is considerably retarded on the tied side, this being another proof of relative stasis. Leboucq has made a special apparatus consisting of a space containing stagnant distilled water placed in the center of a vessel of "fluorescinated" water, the two fluids communicating by capillary drains. As long as the water remains absolutely quiet in the immersed space, the fluorescein does not penetrate. If the slightest circulation is started in the water, one can see, at the ends of the drains, how the fluorescein appears in the form of *Ehrlich lines*. But under these physical conditions the production of the lines is continuous. The intermittent secretion of the aqueous humor is the rule in conditions of physiologic experiment. According to Leboucq, this secretion would depend on the sympathetic.

AQUEOUS HUMOR.—**Magitot** and **Mestrezat** have made a study of the *chemistry* of the aqueous humor of man and the principal domestic animals, and have found a great similarity in the composition of the aqueous in the human and in domestic animals. They made a very detailed examination of the composition of the aqueous taken from the anterior chamber of the horse, and have given their results in a lengthy table. They found also a very close resemblance between the aqueous and the cerebrospinal fluid. The space which the aqueous fills is comparable to a cerebral ventricle, and the quality of the aqueous humor is very similar to the contents of the ventricles.

The ferments in the aqueous humor have been studied in cattle by **Hayano**. He finds the total of reducing substance calculated as sugar to average .06 grams to the liter. In rabbits it is a little more; in man a little less. After death or enucleation of the eye it slowly diminishes, but some remains for a long time if the eye is kept cold and in the dark. **Kumagai** investigated the character of the aqueous reformed after emptying the anterior chamber. and the changes produced in it by the subconjunctival injections of salt solution. He found an increase in the albumin of about 0.1, being about the same in man and the lower animals.

Hagen has repeated his experiments on diseased human eyes with regard to three important points: 1. The rapidity with which the drawn aqueous is replaced. 2. The contents of albumin and fibrin of the new formed aqueous in comparison to the primary aqueous. 3. The formation of vesicles in the epithelium of the ciliary body or iris. The regeneration in the diseased eyes occurred very rapidly, especially in acute iridocyclitis. The regenerated aqueous showed a marked increase in albumin and secretion of fibrin.

The experiments demonstrated that the regeneration of the aqueous under pathologic conditions differs from that in normal human eyes, but is similar to that in normal eyes of animals. While in animals the regeneration takes place exclusively from the ciliary body, it occurs in the human eye chiefly from the iris. This forces us to regard the iris as the most important secretory organ of the aqueous, or to acknowledge that this pathologic transudation of an albuminous aqueous does not prove anything with regard to the physiologic conditions.

After giving uranin internally, **Lindner** watched for its appearance in the pupil as revealed by the light of the nitra lamp, in normal eyes and also in glaucoma and iritis. The appearance was hastened by the instillation of adrenalin or cocain. It appeared earlier in healthy eyes than in the eye affected with iritis or glaucoma, and where both eyes were glaucomatous earlier in the one with lower tension.

Seidel injected the eyes of rabbits with different dyes, and found that *Schlemm's canal* was the natural channel for the flow of the aqueous from the anterior chamber. Solutions of dyes injected into the anterior chamber flow toward Schlemm's canal and from there into the episcleral vessels. No flow of aqueous thru the lymph vessels that open into the anterior chamber was observed. If the solution injected contained particles above a certain size, the filtration was blocked, the intraocular pressure increased, and a glaucoma was produced; thus offering additional proof that there is a flow of aqueous into the anterior chamber, as claimed by Leber. It was found that with a dilated pupil, a greater pressure was necessary to force the fluid into Schlemm's canal than with a contracted pupil.

In another series of experiments, iridectomy was done on rabbits, and trepanation on cats. Three weeks later the eyes were injected, and it was found that both of these operations accelerated the flow of aqueous from the anterior chamber into Schlemm's canal.

Gilbert, in conjunction with **Plaut**, made *serologic* studies and determinations of the albumin content of the aqueous humor after first and second puncture of the anterior chamber. He also did some animal experimentation, and found that the results, as to formation and condition of the second aqueous humor after puncture of the anterior chamber, were the same as in the human. He found that the refilling of the aqueous humor in man and animals depends on the reactive hyperemia of the ciliary body which leads immediately after puncture to an increased secretion of aqueous humor. The total albumin content of the "second" aqueous humor was greater than the "first."

Wolf supplemented Gilbert and Plaut's work on the *morphology* of the aqueous humor. The drops were fixed with methyl alcohol and stained by the modified Pappenheim's panoptic method. In normal eyes and in simple or papillitic atrophy of the optic nerve, no cells were found, or only a few (normally a regular shedding of endothelial cells takes place). In parenchymatous keratitis, from 3 to 105 cells were found; these were mainly degenerated endothelial cells, also round cells and leucocytes. Later the *cell count* was increased, and single iris stroma cells appeared.

In syphilitic iritis, there were as many as 500-600 cells to 1 cu. mm., mainly endothelial cells; they were in better state of preservation than in parenchymatous keratitis; also lymphocytes, later leucocytes. In severe inflammation, iris stroma cells always appeared in somewhat greater numbers; in addition there were always eosinophile cells. In 2 especially severe cases, ciliated epithelia were also found. In nonsyphilitic iritis the cell count was usually under 150, mainly endothelial cells and lymphocytes, iris cells and leucocytes also being found in the acute cases. In nearly all cases of tuberculous iritis, ciliary epithelia and pigment endothelia were present. In a case of choroidal tumor "tumor cells," according to Bruckner, were found.

Testing the aqueous in syphilitic patients, **Gilbert** and **Plaut** found that the first aqueous gave negative reactions, but if the aqueous was again drawn off after 45 or 50 minutes, it was more likely to give a positive Wassermann, altho not so strongly positive as the blood serum. In the same way the globulin test of Nonne was more decidedly positive with the second aqueous.

After the instillation of *cocain* and *atropin* in the eye, **Post** withdrew the aqueous by puncture of the anterior chamber at the limbus, and determined the amount of the drugs present. The average amount of aqueous obtained was about 0.275 cc. If cocain or atropin was present, even in quantities as dilute as 1:200,000, a white cloud was formed by the addition of certain reagents. From his tests, the writer concluded that there is no great difference in the percentage absorption of cocain in any strength. Subconjunctival injections and repeated instillations of cocain were followed by about the same absorption.

Quantitatively, cocain and atropin by instillation were absorbed quite equally. Atropin injected subconjunctively was absorbed poorly. Absorption of cocain was greatest from one-half hour to one hour after beginning fifteen minutes of repeated instillations or after injection. Absorption of atropin was greatest from forty-five to seventy-five minutes after beginning fifteen minutes of repeated instillations. Absorption into the anterior chamber was largely thru the cornea when instillation was used. It was found that, in general, the best method for the absorption of cocain and atropin into the aqueous was that of repeated instillations.

Determinations of the hydrogen ion concentration in the aqueous were made by **Hertel** by means of the Michaelis "indicator" method. Twenty-one cases were examined. These included aphakia, luxatio lentis, cataracta zonularis, glioma, secondary and interstitial cataracts. The purpose of the study was to ascertain what effect the hydrogen ion concentration in the vitreous had on intraocular tension. Hertel concludes that the content of the hydrogen ions in the aqueous bear no relation whatever to the extent of intraocular tension.

In an effort to determine the physiologic processes concerned in the disappearance of the *pupillary membrane* present in fetal life of mammals, **Nordenson** made a series of determinations of the hydrogen content of the aqueous in calf fetuses and in the cows from which they were obtained. He concluded that there is no important difference in the hydrogen content in the fetus from that of the cow; in the series the content of fetal aqueous averaged slightly higher.

To determine the influence of injected medicaments on the amount of *albumin in the aqueous humor*, **Nakamura** and **Mukai** introduced watery solutions of fluorescein potassium, fluorescein sodium, potassium iodid, sodium iodid, potassium ferrocyanid, sodium chlorid, and chlorcalcium per os, subcutaneously, and intravenously into rabbits, and examined the amount of albumin in the aqueous. They found that even slightly toxic solutions, when injected intravenously, increased the albumin, while stronger solutions per os or introduced subcutaneously produced no action. By intravenous injections of hypertonic solutions, the amount of albumin was markedly increased, while it was less influenced by injections of hypotonic solutions even in large quantities. Intravenous injections of hypertonic chlorid of calcium solution increased the amount of albumin, while subcutaneous injections lessened the amount.

To determine the percentage of *sugar in the anterior chamber,* **Holi** has made repeated experiments, according to Bang's method. He found that in healthy men sugar in the anterior chamber amounted to 0.08 to 0.091 per cent., while blood sugar is 0.08 to 0.095 per cent. In healthy rabbits, the aqueous showed 0.116 per cent. and the blood sugar 0.100 per cent. In diabetics the sugar in the anterior chamber changes with the amount of sugar in the blood. After subcutaneous injections of adrenalin, the sugar in the anterior chamber increases; at first rapidly, then gradually; reaches its maximum after three hours, and returns to normal in eight to ten hours. Sugar given by mouth reaches the maximum after two to three hours, and returns to normal in six to eight hours. Sugar was found more rarely in the vitreous than in the aqueous.

Examination of the aqueous humor by **Gilbert** and **Plaut** showed conditions analogous to those in the spinal fluid. An increase in the number of cells was found in inflammatory disease of the anterior part of the eyeball, dependent on the intensity and stage of the process. Leucocytes were found only in acute inflammations, while other cells, including endothelial and epithelial cells, tissue cells and lymphocytes, were found in all diseases. When the aqueous humor was negative, Nonne's globulin test was also negative. There is a globulin increase which is more pronounced in syphilitic than in nonsyphilitic iritis. A slight increase of globulin is found also in parenchymatous keratitis.

The *Wassermann reaction* is found in the aqueous only when it is positive in the blood and when the eye is irritated; therefore it is not ordinarily found in tabes and atrophy of the optic nerve; it was found in only two cases in aqueous humors that were otherwise normal. A study of the regeneration of the aqueous after repeated punctures showed marked increase in the globulins, appearance of a weakly positive Wassermann reaction, and increase in the total albumin.

From examinations of the aqueous humor, **Gilbert** found that the normal aqueous contains no cells, and gives a negative Nonne and Wassermann. In advanced cases of parenchymatous keratitis and iridocyclitis, Nonne's globulin test was found positive. The cellular contents of the aqueous increased with the degree of inflammation of the uvea. The Wassermann reaction was negative for the normal aqueous of a luetic, but was always positive at the height of the disease in parenchymatous keratitis and specific iritis. In a luetic with an iritis that was considered tubercular, the reaction was positive.

Okazaki also verified the positive reaction of the aqueous in many cases of syphilitic eye affections with positive Wassermann reaction. He tried to verify the quantitative condition between the complement fixing immune bodies of blood serum and aqueous humor. In eye affections with marked symptoms of irritation, the amount of immune bodies in the anterior chamber were more or less increased.

PIGMENTED STRUCTURES OF THE PUPIL.—**Van Duyse**, before the Belgian Ophthalmological Society, called attention to irregularities of the pupillary margin, derived from the ectodermic pigment layer of the iris. They are generally located in the upper part of the pupil; are symmetric, and have an interest as evidences of atavism. They are to be distinguished from acquired uveal ectropion following iritis, or in chronic glaucoma; and also from pigmentary deposits encroaching on the anterior surface of the iris.

PERSISTENT PUPILLARY MEMBRANE.—**Fleming** describes a case of persistent pupillary membrane in a girl of fifteen, who had defective vision since birth. In the right eye there was a lace like plaque adherent to the anterior surface of the lens; no strands passing to the margin of the iris. In the left eye there was a similar condition but it was attached to the margin of the iris, and there was an absence of the normal iris pattern. Vision was 6/18.

Prevedi also observed a case of persistent pupillary membrane in a man aged fifty-nine. A delicate thread of tissue extended from the lower outer quadrant of the pupillary margin to the anterior surface of the lens. There were two other fine threads on either side which did not touch the lens, altho there were two points seen on the lens surface where they had probably been attached. A delicate membrane could be seen adherent to the iris. While the appearance of the threads in the pupillary space is not very infrequent, the membrane on the iris surface is rare and may throw some light on the origin of pupillary membranes and reasons for their persistence. The theories which have attempted to explain this are discussed. It is probably true, according to Jannulatos, that the normal pupillary membrane disappears at the time when the vascular lens capsule absorbs, due to cutting off of its vascular supply. The author thinks that when this vascular lens capsule disappears completely, all of the ordinary membrane must be absorbed except where part of it is supplied by an anomalous blood vessel entering it from the iris itself, this blood vessel being entirely separate from the lens capsule and so accounting for the persistence of parts of it.

Axenfeld describes an interesting case of movable pupillary membrane in a young man. The membrane was greyish-white; was thrown into folds when the pupil contracted, and became smooth and more transparent when the pupil dilated. With a Zeiss binocular magnifying glass, it was seen that the membrane was attached to the posterior surface of the iris. Axenfeld believes that it was an acquired, inflamed pupillary membrane, and of prenatal origin, or acquired during infancy.

The circulation of the blood in the vessels of persistent pupillary membranes, a fact which has been demonstrated within the past few years, is referred to by **Vossius,** who cites a case in which the circulation thru the vessels could be observed with the corneal microscope. The blood flow was accelerated at each systole, the rate being about 1 mm. per second. It was also found that the circulation of blood ceased when the intraocular pressure reached 70 mm. Hg. Vossius concluded that with a normal general blood pressure, the pressure in the vessels of the pupillary membrane, which are smaller than retinal arteries on the optic disc, would be about 50 mm. Hg.

CYST IN THE ANTERIOR CHAMBER.—**Vogt** describes pigmented cysts of the pupillary margin, which he believes are not particularly rare. The cysts appeared brown and glistening by the light of the slit lamp; were easily transparent, and grains of pigment on the cyst could be easily recognized. In one case, which presented a number of cysts in both eyes, they were situated on the inner surface of the iris, and extended only to the free border. All cases observed had received numerous instillations of pilocarpin and eserin, and Vogt considers the possibility of their being caused by pilocarpin-eserin. In two cases he observed the development of the cysts for a period of two months, and one case was observed for three years, when they spontaneously disappeared.

CHOLESTERIN IN THE ANTERIOR CHAMBER.—**Böhmig** observed, in an aphakial eye, many cholesterin crystals, which increased so rapidly thru repeated intraocular hemorrhages, that a large part of the newly formed crystal could be seen upon the last one. The sight disppeared by degrees thru detachment of the retina.

PUPILLARY CENTERS.—**Ludwig** and **Schilder** describe a rare combination of rhythmic pupillary contractions, synchronous and associated with nystagmus, in a case of encephalitis with bilateral external rectus paralysis, pupillary nystagmus, convergence nystagmus, and bilateral and synchronous twitching of the orbicularis muscle. They also report a case of eclampsia with sudden right hemiplegia, dysarthria, and a complicated combination of ocular paralysis and nystagmus. With a vertical nystagmus in the left eye, there was associated a left pupillary nystagmus. In both cases the lesions were assumed to be in the tracts from Deiter's nucleus to the nuclei for the eye muscles.

Lutz studied a case of alternating hemiplegia (Millard-Gubler), with special reference to pupillary reactions, and found that during the entire course of the disease the pupils were equal and of medium size. He assumed from this observation that the lesion in the tegmentum of the pons had not reached the floor of the fourth ventricle, and concluded that a lesion of the brain stem will be accompanied by a homolateral miosis only when it reaches the highest and medial part of the substantia reticularis.

Pupil Measurements.—**Kleefeld** believes that the methods used for measuring the photomotor reflex of the pupil are either insufficient or require facilities obtainable only in the laboratory. He gives the conditions essential for the adoption of a universal method as precision and facility of application, and in his article he discusses first the history of pupillometry, with a description of different pupillometers; second, a description of the new pupillometer; third, the results of experiments made with his new method and his conclusions.

Trendelenburg describes a slight modification of his apparatus for measuring the distance between the eyes, pupils, corneae, and exophthalmus, originally described in the Klin. M. f. Augenh. 45:427.

Fackenheim has devised an instrument to register the strength of light required to cause a pupillary reaction. The apparatus consists of an electric lamp whose light strength is regulated by a resistance and the result registered on a scale at the beginning of the pupillary reaction. The scale is graded from 0 to 100 and the results can be definitely stated in terms of "P. R. Meter" (pupillary reaction meter). With healthy individuals, the figures 5 to 15 on the scale are considered normal, and Fackenheim believes that in the future one will not speak of the pupillary reaction as being prompt, sluggish, or absent, but will be expressed in definite terms as measured by the apparatus.

The differential pupillometer of **Hess** is intended to determine the slightest difference of light intensity that will affect the size of the pupil. This is a better indication of the sensitiveness of the pupillomotor region than is the reaction of the pupil. It gives better information of the probable visual acuity of the eye in connection with cataract.

Mydriasis.—A method of observing the equality or inequality of the pupils during mydriasis is described by **Gourierec.** An equal number of drops of 4 per cent cocain solution was instilled in each eye, and the induced mydriasis noted in a dark room, and whether any inequality developed before complete dilatation. He believes that the method lays stress on the inequalities already existing, or makes them appear when they were latent or only slightly perceptible by less exacting methods. Provoked mydriasis applied in 211 patients, in whom a thoro physical examination showed no pathology, produced irregular pupils in 21 out of 100 cases, while in 309 cases, under the same conditions, the ordinary examination of the pupil without induced mydriasis showed inequality of the pupil in 15 out of 100.

Koller believes that sufficient attention has not been given to the vasomotor changes, caused by mydriatics and myotics, as a cause of mydriasis and myosis. He points out that in inflammatory congestion of the iris the vessels are widened and full, hence the pupil is contracted, also that narrow pupils are the rule in people whose cerebral arteries are distended. Animal experimentation shows that the pupils can be dilated by emptying the blood vessels and can be narrowed by filling them, and he points out that all known mydriatics have a constricting effect on the blood vessels of the iris, and myotics have a dilating effect on the iris vessels.

Redlich found that in cases of hysteria and epilepsy, pressure of the hand on the eyeball, while the head is bent back and the breath is held, causes a very marked dilatation, which is only slight in a normal person. Experiments showed that after the removal of the sympathetic nerve, irritation will still cause dilatation, while irritation fails to cause any dilatation after cutting of the oculomotor. He therefore attributes the dilatation to a cortical inhibition of tone of the sphincter, with the dilatator ruled out, and this is seen more clearly with the use of cocain. Upon the inducing of a strong muscular action in a patient under cocain, there was a maximum enlargement and staring which pressure without cocain had not caused; showing that there is an evident dependence of pupil phenomena on muscular action.

MacDonald reports the case of a woman who suddenly developed complete dilatation of the left pupil accompanied by supraorbital neuralgia and other disorders, following a cold motor drive. The condition cleared up. She had recently used a belladonna linament for a sprained knee. The neuralgia may have been due to the action of light on the relatively unprotected retina.

Descomps believes that there is no doubt about the action of the muscles controlling the closing of the pupils, but the question of mydriasis has not yet been explained. He refers to the two nerves controlling movements of the iris, the oculomotor and the sympathetic, which end in the ciliary ganglion, which may be considered as the true pupillary center. The fact that a bisection of the sympathetic does not prevent dilatation of the pupil, and both light and accommodation reflexes remain, has been demonstrated. He discusses passive pupillary dilatation following inhibition of the action of the sphincter, and states that contraction and dilatation of the pupil depends solely upon changes in the tonicity of the sphincter. The reflex tract from the cerebral cortex to the cilio-spinal center, and from there thru the sympathetic nervous system to the ciliary ganglion, is described and also the pupillary reflex tract. **Bianchi** writes on the frequency of right mydriasis in syphilis of the nervous system.

ANISOCORIA.—**Lutz** accepts the possibility of an anisocoria based upon unilateral heredity, as it has been proved that the correlation between pairs of organs can be totally or partially lost solely by the complicated mechanism of heredity. He believes that a physiologic anisocoria can be accepted only where there is absolute certainty that all parts of the path of the pupillary reflexes are intact, and he considers it a very rare phenomenon. Reche found among 14,992 cases of anisocoria, only 145 without cause, i. e. 1%, and also concluded that anisometropia can not be a cause of physiologic anisocoria. Frankel divided the anisocorias into three groups: 1. Organic anisocoria caused by lesions in different parts of the path of pupillary reflexes. 2. Functional anisocoria, which appears transiently in the course of illness such as pneumonia. 3. Morphologic or physiologic anisocoria.

From the observations of Reche, Frankel, and others, it would appear that the physiologic anisocoria is not a definite anomaly, and great precaution should be exercised in its diagnosis. Anisocoria based on unilateral heredity doubtless exists, inasmuch as Frankel and others have published such cases, but Lutz finds that they are much rarer than is generally believed. **Brooks** reviews some of the clinical conditions associated with inequality of the pupils, and believes that, with the exclusion of eye disease and refractive errors, unequal pupils are always pathologic. He refers to the importance of determining whether the lesion is an irritative or a paralytic one in making a proper interpretation of the occurrence of unequal pupils.

Chenet and **Noyer** studied the pupillary reaction of Tournai (normal physiologic pupillary inequality during abduction) with several thousand patients and also with a large number of animals, and concluded that: 1. In normal subjects, even those having ametropia, dilatation of the pupil of the eye in abduction is the rule, and that the inequality of the pupils is due to dilatation of the pupil of the eye in abduction. 2. The reaction of Tournai was negative in the rabbit and the horse; positive in the cat and dog. 3.

Mydriatics suppress or attenuate; myotics abolish the reaction. 4. In the pathologic cases the reaction of Tournai showed variations. In all the ocular affections in which the iris was mobile, even in those cases where there was only light perception and in those with no vision, the reaction was positive, showing that the reaction is an associated movement independent of vision.

Caillaud has verified the observation of Tournai that anisocoria is the rule in sidewise glance. If the subject turns the eye toward the right, the right pupil is larger; there is dilatation of pupil looking toward the temporal side, and contracting of pupil looking toward the nose. Atropin causes the phenomenon to disappear when the dilatation is greatest. With cocain, the pupil is capable of dilating. This phenomenon is true even in pathologic cases, except in cases of myosis, especially senile myosis.

Lafon calls attention to the fact that inequality of the pupils is not always of syphilitic origin, but that it may exist in many unilateral acute or chronic diseases of the thorax and abdomen, the dilated pupil being on the diseased side, as pointed out by Roque, and he suggests the name of Roque's sign for this phenomenon. Inequalities of the pupil due to this cause may be distinguished from those due to disease of the central nervous system by the fact that the former are exaggerated in darkness and decrease or disappear in light, while those due to lesions of the central nervous system are exaggerated in the light and decrease or disappear in the darkness.

Terrien states that the oculomotor syndrome may be induced by a number of affections, such as bulbar, medullary, cervical or pleural lesions, lesions of the mediastinum, and by derangement of the glands of internal secretion. Among the oculopupillary symptoms he mentions anisocoria, which may be present. If inequality of the pupils is present, and the reaction to light is normal on both sides, and the reaction to darkness is sluggish on the dilated side, a positive diagnosis of paralysis is made. Instillations of cocain will determine whether myosis is present. The pupil in myosis will remain unchanged, while the healthy side will show extreme dilatation. Myosis appears to be more marked after extirpation of the ganglion than after simple section of the nerve.

Sergent states that anisocoria can be observed in the course of pleuropulmonary affections in four varieties of cases: 1. It corresponds either to an early lesion causing stimulation of the sympathetic (mydriasis), or to a chronic lesion which has destroyed these sympathetic fibers (myosis). 2. Myosis on the side of the apex lesion is associated with a diminution of the palpebral opening and retraction of the eye. 3. The condition is associated with vasomotor disturbances of the cheek and ear on the same side. 4. Mydriasis is associated with vascular symptoms, but the ocular and palpebral signs are absent. It is seen in patients with old torpid lesions, with pleural and mediastinal reactions. The authors find that the inequality of the pupils may be latent, in which case the use of mydriatics or myotics helps to recognize the condition by exaggerating the abnormal condition; the mydriatic producing a more complete and rapid dilatation on the affected side and myotics causing a more complete and rapid myosis. Special importance was attached to a latent mydriasis, for it was frequently found in connection with small early lesions, and was an aid in diagnosis.

MacPherson mentions a case of epidermoid papillary cystoma invading the third ventricle which presented, as ocular symptoms, decrease in vision, anisocoria, and a slow reaction of the pupils to light.

Physiologic Pupil Reactions.—As a result of experiments undertaken to determine the reactions of normal and diseased pupils to the Faradic current, **Ruttin** arrived at the following conclusions as to normal pupils: 1. Normal pupils react very slightly to a weak current (15 to 20 volts). 2. The reaction consists of a slight expansion upon the entrance of the current, followed by a slight oscillation; finally equilibrium is established. 3. Both pupils react similarly. 4. The reaction also occurs when the current approaches the eye. 5. The reaction is strongest when the current is introduced thru the lower lid. Experiments were made on patients with various eye disorders, and it was found that the pathologically wide pupil is contracted by the Faradic current when the lesion is central, and is not influenced when the lesion is peripheral.

Fackenheim measures the pupillary reaction by determining the amount of light necessary to produce a reaction. He uses a small electric lamp in which the intensity of the light necessary to give a pupillary reaction is regulated by a rheostat and read off on a scale, the lamp being kept at a constant distance from the eye. One eye is covered and the eye under examination is directed toward the light, which is gradually turned on until the reaction occurs. Not only is the average reaction in a normal person determined, but also the changing reacting power in disease. The average index in health was found to be 5 to 15, while a higher index denotes a disturbance in pupillary reaction.

To determine the response of the average pupil to various intensities of light, **Reeves** made a series of experiments, which he has illustrated with graphs. To determine the rate of closing of the pupil, a motion picture camera, which took a picture every tenth of a second, was used, and the pictures taken as the pupil closed from its maximum to its minimum diameter. The results showed that the average pupil reached its minimum in less than five seconds and the greater part of the contraction occurred within the first two seconds. In order to get data on the rate of opening of the pupil, an electrical device was used, and it was found that the opening of the pupil to a maximum diameter required as many minutes as it required seconds for it to close at a minimum.

In discussing the paper of **Brown,** Patrick called attention to the inequality in size of the two pupils when one was more illuminated than the other. He had called attention to this in Germany and had been corrected "with characteristic Prussian abruptness," but had many times corroborated the observation.

Rochon-Duvigneaud shows that in the screech-owl, the pupillary reaction is only complete when the light falls on the fovea which is situated on the temporal side. One may wonder if there is not in these birds, especially according to the direction of their gaze, a certain degree of binocular vision. Rochon-Duvigneaud made a further study of this subject, and with the aid of a simple ingenious apparatus, shows that the area of maximum pupillary contraction is situated at from 20° to 30° from the inner side. He was able to establish the fact that the posterior poles of the eyes can receive the image of a lamp placed more than a meter away, and arrives at the conclusion that binocular vision must exist for the fovea.

Pathologic Pupil Reaction.—**Rad** refers to a case of immobility of the pupil without involvement of the external eye muscles, occurring after a blow upon the occiput, which was reported by Axenfeld, and a similar case reported by Lowenstein. In both of these cases there was a one sided fixed pupil with myosis, and no serologic evidence of lues. He also reports a case that came under his observation in which, following a fracture of the skull, there was a fixed right pupil with both pupils irregular. Consensual reaction was absent on both sides; convergent reaction present but slow; eye movements were free in all directions, and there were no fundus changes. Wassermann reactions were negative. Rad believes that on account of the absence of light reaction in both eyes, a peripheral lesion in the ciliary ganglion could be ruled out, and assumes that there was a hemorrhagic lesion in the midbrain in such a location as to involve the pupillary fibers to both eyes. **Foster** states that when the reactions to light and accommodation are both slow or abolished a drop of eserin solution may be instilled in the eye. If the ordinary effect on the pupil is produced, the lesion lies back of the ciliary ganglion. If the effect of the eserin is less than normal, the lesion is in the ganglion or in front of it.

Reitsch writes on the functional test of the pupillomotor zone and its value in diagnosis. The usual methods of testing pupillary reaction, whether the light is thrown into the eye from in front or from the side, serves to make known disturbances in the centrifugal path, as they occur in organic nerve lesions, and are sufficient to diagnose pathologic conditions of the iris and grosser changes of the centrifugal path. Prompt active pupillary reponse is normal. But it would be as much an error to make thereby a deduction as to the integrity of the pupillomotor zone and the related macula contained in it as to judge the heart from an objective examination without a test under strain. The load for the pupillomotor zone is a light stimulus of known strength and duration. For normal function the centripetal path must be intact; any disturbance will be accompanied by degeneration of functional efficiency in the area of light reception.

With the mirror ophthalmoscope, the light is thrown into the eye in the direction of the axes of vision at a distance of 40-50 cm. to avoid convergence reaction, and the lens used for easier examination. A certain duration of contraction of the pupils as well as a good primary contraction is demanded of a well functioning zone. With the graver disturbances, rapid relaxation takes place; with milder grades, the first prompt pupillary narrowing is followed by a gradual widening, then again a narrowing. Comparison of the two sides is essential. Since the macula is a part of the pupillary motor zone, the function of the latter depends on the condition of the former and visual acuity. The test of duration of reaction finds its value in congenital amblyopia, as an indication for operation in gray cataract, and particularly in an early retrobulbar neuritis, mostly as a sign of multiple sclerosis.

Wick describes a case of total loss of pupillary reactions, occurring in a girl nineteen years of age, and accompanying a traumatic neurosis caused by a head injury. In the right eye the pupil was displaced somewhat upward and inward; there was no reaction to light, but convergence reaction was present. The left pupil gave a definite but imperfect reaction to light, with full contraction on convergence. Wassermann was negative.

Kempner describes pupillary disturbances in hysteria, reports a case, and shows that it was one of hysteria and not of epilepsy, in spite of the dilatation, inequality and fixity of the pupil. Kempner believes that from the fixity of the pupil, the diagnosis of epilepsy can no longer be made in all cases, altho it must be admitted that a fixed pupil in hysteria is a great rarity. He considers it likely that not only the inequality of the pupils, but also the dilatation of the pupil depends not alone on the irritation of the cervical sympathetic, but that in hysteria, similar to epilepsy, the cerebral cortex is in a state of irritation which is to be considered as a cause of the mydriasis.

While bilateral paroxysmal miosis, as well as mydriasis, have often been observed as accompanying symptoms of *hysteria,* and described by such men Féré, Pansier, Westphal, Karplus. Binswanger, Bumke, Pelizous, Oppenheim, Radlich, etc., **Focher** states that no mention has been made of pre or intraparoxysmal unilateral high grade miosis with retention of reaction to light as an early symptom of typical hysteria.

A. B., a painter, 34 years old, can remember no other illness save a lead-poisoning in 1915, during which his teeth fell out. Not alcoholic; smoked to the extent of 15 cigarettes a day. In February 1916, he was struck unconscious from bomb pressure. Upon regaining consciousness, he had pains in the vicinity of the heart and a tremor thru the entire body, which lasted two or three days. This condition ended in a convulsion (10 to 15 min.), after which his condition improved. Since this attack he was seized with spasms every four or five days. For several weeks he suffered from gastric pains. Examination December 19, 1919, revealed a moderately developed man of medium height, badly nourished. No teeth. Diffuse bronchitis. Other viscera normal. Tongue clean, abdomen soft. No pressure or palpation symptoms. Abdominal reflexes not obtainable. Tendon reflexes equally active on both sides. Pupils equal, miotic, reacting directly and consensually to light, accommodation and convergence. Pulse 72. Excentric pupils. On December 30, he complained of a burning pain in the epigastrium one-half hour after eating. Attack of clonic spasms. On December 31, during examination of the pulse, the right pupil contracted visibly and the pulse slowed up. The pulse could not be counted, as the patient was seized with an attack lasting two or three minutes. On January 20, an attack was brought on by suggestion, during which the pupils remained unaffected. The attack was checked after one minute by verbal suggestion. On February 26, after verbal suggestion, a complete repetition of the attack of December 31 took place, including right miosis, etc. After one-half minute, the attack was checked by verbal suggestion. The other symptoms suggested a temporary vagotonia which apparently had no connection with the spasms, but might have caused the peculiar pupillary phenomena.

Jellinek mentions a case of unilateral loss of pupillary reflexes and *Horner's syndrome,* followed by bilateral Klumpke's paralysis, in a previously healthy man who received an electric shock of 5,000 volts. Two and one-half hours after the accident, the left eyeball had deeply receded; the palpebral fissures seemed narrower; there was enophthalmus and loss of pupillary reflex to light. Horner's syndrome gradually disappeared and at the end of three weeks, both eyes appeared alike. Klumpke's paralysis, slight atrophy and paralysis of the muscles of the forearm and hand, appeared two or three weeks after the accident. The eye symptoms indicated either a morbid change in the cervical sympathetic, or a disease of the segments of the lower cervical spinal cord. Wassermann reaction was negative.

A case of bilateral loss of *pupillary reflex* with anisocoria was observed by **Junius** in a patient who had an attack of grippe fifteen months previously. Wassermann test was positive and the author was uncertain whether the pupillary phenomena were due to grippe or lues. Cases from the literature are cited in which the authors believe that such pupillary disturbances may be traced to grippe, and other authors are cited who believe that loss of pupillary reflex is an unmistakable sign of syphilis.

Franke reports a case of irregularity and loss of pupillary reaction occurring in a case of encephalomyelitis complicating influenza. Three months after the onset of the pupillary disturbances, the pupils were still irregular and reaction sluggish. **Westphal** called attention to alternating absolute rigidity of the pupil occurring in epidemic encephalitis.

Kafka describes the case of a 35 year old man admitted to the hospital with the diagnosis of "ocular paralysis." On examination under illumination, on looking at a distance, the right pupil at the beginning is moderately contracted, more so than the left. On looking at a distance for a longer period, the right pupil is seen to dilate gradually and after 20 seconds becomes much wider than the left pupil. The right pupil does not react to light, the left reacts promptly and well. Increasing the intensity of illumination has no effect on increasing the pupilliary dilatation of the right eye, but the left pupil becomes more contracted, in spite of the increasing effort to accommodate.

Both pupils react well to accommodation and convergence; as a matter of fact the right reacts with lightning like rapidity at the slightest impulse at convergence. During various tests, movements of the iris are uniform thruout its entire circumference. Repeated tests for contraction and dilatation do not change the tempo or the kind of reaction. It was not the "tonic pupil" seen in Thomsen's disease. On throwing light into the right eye, the consensual reaction in the left eye was very prompt, but on throwing light into the left eye there is no consensual reaction in the right. Both irides are of normal color. Two drops of a 3% solution of cocain produced moderate dilatation of the left pupil, but it reacted to light and accommodation much less promptly. The right pupil did not seem to be affected by the cocain. Forty days after there was improvement in the ophthalmoplegia.

Kafka thinks that there probably exists an isolated reflex pupillary rigidity, the lesion localized in the centrifugal part of the reflex arc (nerve root of the oculomotor) indicating separate fibers for convergence and for light reflex, fibers which can be electively damaged by lesions at the base of the brain. He also believes that there must exist inhibitory fibers for the pupillary sphincter in the oculomotor, which may also become diseased in an isolated manner.

Engelking refers to a case of total congenital *color blindness* in a child of five years of age. The child could scarcely see at all in a bright light, while vision was nearly normal in a dim light. When exposed to bright light, the pupils did not react. As the light was dimmed, the reaction increased until it was approximately normal in the dark. Engelking adds that the pupil reactions of totally color blind persons in bright light decrease in proportion to the defect in the visual purple.

Gehrecke calls attention to *tonic convergence movements and tonic accommodation.* In the last few years remarkably slow movements of the inner ocular muscles—sphincter iridis and ciliary muscle—which Axenfeld terms "tonic" movements, have been observed. We, therefore, differentiate "tonic convergence movement of the pupil" and "tonic accommodation." Tonic convergence movements of the pupil may be caused either by fixation of the finger in front of the eye, or by unilateral accommodation from covering the other eye. Tonic convergence movements of the pupil were sometimes also observed as accompanying firm closure of the eyelid or repeated closure of the eyelids. Some cases showed simultaneous, some isolated tonic accommodation and tonic convergence movements of the pupil. Tonic accommodation has never yet been observed by itself.

Gehrecke tabulates twenty-one cases reported in literature, and shows that the rapidity of pupillary reaction in convergence may be from 4 to 5 seconds, as well as from 10 to 15, even from 17 to 20 seconds; the time for pupillary dilatation may be from 1-2 seconds up to 2 or even 5 minutes; while the tension of accommodation is from 3 to 4 seconds; the atony from 2 to 15 or even to 20 seconds. Gehrecke cites the following case history: Woman teacher, 45 years of age, scarlet fever and nephritis at 16; measles at 19; diphtheria without paralysis at 30. Since 1903 cardiac palpitation; weakness; easily fatigued.

Ocular findings; right pupil more contracted than left; "reaction to light" completely absent in right, rapid and generous in left eye. On holding the finger up at 20 cm. distance, the right pupil contracts distinctly yet slowly and sparingly; the left pupil contracts rapidly and generously. In looking far off, the right pupil dilates only after 1-2 minutes to its original size. The same symptom is observed in accommodation (covering the left eye). On repeatedly closing the eyelid firmly, the left pupil markedly contracts and as rapidly dilates, while the right pupil shows no certain contraction.

Consensual reaction to light may be promptly induced in left eye and is absent in right. Bilateral prompt accommodation to near and distant objects. Fundi negative; normal visual acuity. Achilles tendon reflex absent; no other changes in nervous system. Negative Wassermann reaction and lumbar puncture. The primary etiologic factors are lues and its consequences, alcoholism, diabetes, trauma, measles, Basedow's disease and migrain. The muscle should probably be taken as producing the phenomena, especially since in Gehrecke's case partial atrophy of the sphincter was suspected in microscopic observations of the iris.

Behr believes that the problem of tonic convergence reaction of the pupils involves so many unsolved problems that we cannot obtain reliable clinical information from it. He has made a study of eight cases coming under his own observation, and an analysis of cases reported in literature, and concludes that neither syphilis nor any general disease of the central nervous system is a causative factor. The cerebrospinal fluids were normal, and a transition from pupillotonia to reflex or absolute rigidity of the pupil or ophthalmoplegia interna was never noted. Certain general diseases have been accompanied by pupillotonia, indicating that a toxemia may be a factor. The anomaly differs essentially from every other disorder of the pupil, and should be assigned an independent clinical position.

The anatomy of the eye and pupillary reaction in different pathologic conditions are briefly reviewed by **Russell.** *Syphilis,* progressive paralysis or tabes cause distant pupillary changes, consisting of primary affections in the nerve at origin or periphery, inflammatory or degenerative, or due indirectly to inflammation of the surrounding tissue (exudates, hemorrhages, thickenings, and neoplasms). Seventy per cent of all cases of *syphilis* have nervous manifestations in the early secondary stage of the disease. Intraspinal medications six weeks to three months after the initial infection is the only hope of satisfactory results in neurosyphilis. Treatment may be intravenous with mercury injections, intraspinal and intracranial. Iodids may be given by mouth. Mercury injections given along with salvarsan will prevent optic neuritis. A preliminary course of mercury should be given in vascular syphilis, as shown by hemorrhagic retinitis.

Stalberg, in discussing disturbances of the pupil, classifies the disturbances of pupillary reflex as follows: 1. Centripetal disturbances. 2. Isolated reflex pupillary stiffness. 3. Centrifugal disturbances. 1. Centripetal disturbance is indicated when one eye shows increased or decreased reaction to light while the consensual reaction of the other eye as well as the pupillary contractions to convergence and accommodation remain undisturbed in both eyes. The lesion causing such a disturbance must be somewhere between the epithelial layer of the retina and primary visual center or corpora quadrigemina. 2. The isolated stiff pupil or Argyll Robertson pupil reacts neither directly nor indirectly to light, but reacts well to convergence. This symptom is pathognomonic for tabes and paralysis. This symptom is not necessarily connected with any lesion of the peripheral neurons, and can therefore not be classified with centripetal disturbances. The third group consists of disturbances that originate in lesions of the centrifugal or motor portion of the reflex apparatus which includes the sphincter nuclei, the oculomotor nerve fibers, i. e., ciliary ganglia and ciliary nerves.

Thus it follows that centrifugal disturbances may take the form of (a) paralysis of the sphincter alone (absolutely rigid pupil), or (b) a combination with paralysis of other branches of the oculomotor nerve. Thus ophthalmoplegia interna or externa may develop. Absolute stiffness of the pupil is not an accurate description, as a certain amount of dilatation is obtainable thru the sympathetic. The etiology of centrifugal disturbances may be found in intracerebral lesions, disease or injury of the oculomotor nerve, or of the iris. Syphilis and tabes are the most frequent causes of such lesions. In postdiphtheritic ocular paralysis, the pupil reacts well to light but not to accommodation or convergence, thus presenting the opposite condition to the Argyll Robertson pupil.

ARGYLL ROBERTSON PUPIL.—**Rizzo** calls attention to the Argyll Robertson sign and the sign of Rochon-Duvigneaud and Heitz (absolute pupil rigidity) as being two of the best known signs in neuropsychiatric practice, but considers their pathogenesis as very obscure and research reports as contradictory. The causal lesion of the A-R sign, according to Dejerine, would be located in the portion which unites the anterior quadrigeminal nodules to the nuclei of the 3rd pair; according to Mendel it would be in the ganglion of the habenula; according to Bechterew in the iridomotor nuclei of the 3rd pair. Mauthner admits a radicular lesion of the same nerve, and Wolf a degeneration of the fascia of Goll in the superior portion of the cervical medulla. Morina, Lafon, and Sala locate the lesion in the ciliary ganglion. Rizzo has studied the ciliary ganglion with its afferent and efferent nerves in individuals who presented both the A-R sign and that of Rochon-Duvigneaud, and gives details of his examinations and findings and reports his conclusions.

Pálich-Szantó saw in a man of 21, following an automobile accident which left a scar in the right brow, complete loss of direct light reaction in the right eye, altho the indirect reaction to light thrown in the other eye remained good. Reaction with convergence and accommodation was also prompt. The retinal vessels were enlarged and tortuous. The reactions in the left eye were normal.

Brooks refers to Magitot's description of traumatic Argyll Robertson pupil, which is of interest on account of the location of the lesion. Magitot states that, without doubt, it is within the orbit, but not in the retina because the consensual reflexes still exist; not in the ciliary ganglion, because of the mydriasis present, and not in the sympathetic center, which is too deep to be affected by a purely ocular nonorbital traumatism. He locates the diseased organ within the globe in the "choroidal ganglion." In a case of lost light reflex following encephalitis, **Garvie** saw the reflex restored during sleep.

Babonneix discusses the question of how far the A-R sign may be considered as conclusive evidence of the existence of syphilis, and concludes, after an analysis of apparently exceptional cases, that there exist in the literature some cases of Argyll Robertson sign which seem independent of syphilis. These cases are, however, so exceptional that in practice the recognition of this symptom signifies nerve syphilis, and should, in the immense majority of cases, direct the treatment.

Barkan describes two cases of tonic convergence reaction of the pupils, and discusses 20 cases from the literature. Of these, 9 cases were syphilitic; in 9 other cases syphilis was not excluded, and in only two cases does he exclude syphilis. **Fleck** has written on isolated reflex immobility of the pupil and lens.

Behr examined 260 cases of reflex rigidity, absolute rigidity, and ophthalmoplegia interna, and found that in reflex rigidity the pupil is smaller, and in absolute rigidity it is larger than normal. Reflex rigidity with normal convergence reaction is an important sign of lues of the nervous system, and in true Argyll Robertson pupil the lesion is above the nucleus, the nucleus and the peripheral motor tract being uninjured; but some cases that are apparently Argyll Robertson pupils are really cases of absolute rigidity that have not completely developed and the anatomic lesion is lower down. Behr found that reflex was most frequent between the ages of 40 and 50; absolute rigidity between 30 and 50; and ophthalmoplegia interna between 20 and 30.

PARADOXIC PUPIL REACTION.—An editorial in the *Medical Record* calls attention to the paradoxic pupil reaction (dilatation of the pupil when light is thrown on it), and the possibility of its being an indication of a serious organic affection of the nervous system, possibly of luetic origin. It has been attributed by some to a synergy of movement with the pupil of the other eye, and by others as a phenomenon depending upon the orbicular reaction of the pupil (Piltz's phenomenon). Frenkel denies the paradoxic character of the reaction, and considers it as the result of movements associated with those of divergence. Silex assumes it is a permanent contraction with accommodation, probably due to some cerebral irritation or a spasm of accommodation. The rays of light falling suddenly on the pupil in these circumstances paralyze the active nerve fibers and thus give free play to the dilatator muscle. Paradoxic pupil reaction has also been explained by a phenomenon similar to hippus.

Tournai describes a case of pupillary inequality with paradoxic reactions in extreme sidewise glance. He reports a case of tabes with Robertson's sign and pupillary inequality, who presented an inverse reaction. When looking to the left, the inequality tended to increase by contraction of the left pupil and dilation of the right pupil; in looking to the right, the inequality tended to disappear thru dilatation of the left pupil.

HIPPUS.—**Fleischer** has observed a case of veronal poisoning, with narrow pupils, no light reaction, and corneal reflexes absent. During thirty-six hours of unconsciousness, there was great variation of the pupils, myosis to mydriasis. Total dose taken by patient was ten grams of veronal.

The Uveal Tract

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This section reviews the literature from March, 1921, to March, 1922. Sympathetic disease is considered separately in the next section. Many uveal diseases are included among the ocular lesions of general diseases and are referred to under that heading. For previous literature see Ophthalmic Literature, 1921, v. 17, p. 142.

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DIGEST OF THE LITERATURE.

ANATOMY.—**Guist** found that in 20 out of 8,800 patients with *dark irides*, the pupil did not dilate or lose its reaction after instillation of homatropin for hours. By 1% atropin, a paralysis of the sphincter was attained after from 50 to 60 minutes. In light irides this generally occurs after from 15 to 20 minutes. He demonstrated one case in which after one abundant instillation of homatropin, the accommodation was paralyzed, but not the sphincter. In sections of the iris of a negro, the anterior limiting layer was continuously black, no visible cell borders, no crypts, the chromatophores filled with pigment, the bundles of the sphincter enveloped in a pigment capsule, the chromatophores double the size of those in a light iris, without increased number. The *clefts* of the iris showed a scanty communication with the surface. Clinically the iris of such cases is rather smooth, without crypts, covered with brown-black pigment. Guist therefore sees the cause in a mechanical impediment to the entrance of the poison from the anterior chamber into the iris. Possibly also a light iris may show such behavior toward mydriatics.

Fergus thinks it very important to ascertain if the races without crypts of the iris are more subject to glaucoma than others.

The structure of the anterior layer of the iris in man, the apes, and the higher monkeys has been studied by **Wolfrum.** He finds it essentially similar to that previously described for man. In the endothelial layer are found pigmented and unpigmented cells with nuclei near the surface and processes extending deeply. The bounding layer was a fine felt of connective tissue fibers. The anatomy of the albino eyes is the subject of a thesis by **Dresel.** The anatomy of the iris is well described in a chapter of thirty pages that opens the book of **Magitot.**

IRIS FLOCCULI.—**Greeff** observed in otherwise normal eyes of a healthy boy, aged 6, about 7 interruptions of the upper pupillary margin, from which grape like black nodules projected down into the pupillary area. They are encountered not very infrequently in normal human eyes, and occur almost regularly in herbivorous animals, chiefly ungulates, e. g., the horse, camel, sheep, goat, etc., but also in other species. Altho they may appear as granule papillomas, or congenital ectropium uveae, they are of uniform nature, and were termed by the zoologists, Leukart and Weber, flocculi iridis. They are always congenital, almost always situated at the upper half of the pupil and about equal on both sides. Generally they do not change in the course of life. Wicherkeiwicz (Graefe's Arch. 1891, p. 204), however showed that they may become detached and float in the anterior chamber, as foreign bodies or cysts. Fuchs observed such a case and collected others from the literature, and Greeff saw one in which such a floccule was attached by a very thin thread, that might have torn at any moment. The flocculi in the present case consisted of a thick head and thin neck, perhaps a preliminary stage of such occurrence. Apparently the flocculi in man represent a true atavism.

Descending further down in the animal series, the flocculi may be residual; or, according to others, (Franz) preliminary stages of the operculum or umbraculum pupillae, a process of the iris hanging down from the upper pupillary margin in some fishes and amphibia. If this hypothesis is adopted, it explains why the flocculi always occur on the upper pupillary margin.

ANOMALIES.—**Rumbaur** saw with the binocular corneal microscope and the focal light of the Nernst slit lamp, under a magnification of from 60 to 70, star shaped brownish and white deposits on the anterior capsule of the lens as *remnants of the pupillary membrane.* He estimates their occurrence in from 35 to 60% of all individuals, and found them in all possible anomalies of the eye. In myopes they were especially frequent, but even in the most marked cases no deterioration of vision was ascertained. The stars occurred at the region of the pupillary margin, concentric with it. Examination with the slit lamp microscope distinguishes them from old iritic deposits.

Ellett showed a woman, aged 39, with *coloboma of the iris,* choroid and optic nerve of right eye. V. R. 20/200, V. L. 20/100. The left eye seems to have no trouble other than an error of refraction, but there is nystagmus in both eyes. The coloboma of the iris extends to the periphery, down and a little in, the large coloboma of the choroid involving the optic nerve. The edges are lined with pigment deposits around the upper end, similar to the pigment changes in retinitis pigmentosa.

Merz-Weigandt describes a very rare atypical *bridge coloboma* downward and outward of the left eye of a woman, aged 39, whose parents and sisters and brothers had no abnormalities, and an atypical partial coloboma upward and outward of the right eye. He then gives a review of the literature. He adopts the view, obtained by von Hippel, von Szily and Koyanagi from their breeding experiments, that the genesis of colobomas must be attributed to the hereditary transmission of the germ; and mentions the opinions of Elschnig and others of the active proliferation of the margins of the secondary ocular vesicle in abnormal direction. Also the views of von Szily and Lindahl, who attribute the coloboma to arrest of development at a very early period, normal indentations of the margin of the ocular cup. Thus by the combination of these observations, the typical and atypical colobomas are given a uniform explanation of their origin.

Poduschka showed a child of 2 months with atypical congenital coloboma, a complete defect of the lateral half of the iris. **Schott** relates 2 cases of family occurence of *coloboma of the macula,* so far not reported in the literature, in 2 sisters of 8 and 7 years. It consisted in each eye of a horizontal oval focus with sharp pigmented borders. The area was partly yellowish red, partly white, in which numerous remnants of choroidal plexus were imbedded. In one eye there was a white marginal crescent. V. from 5/36 to 5/18. In the left eye of the younger child, a large retinal vessel crossed the focus, smaller ones transgressed its borders and were lost in it. A brother of the father, aged 31, had the same affection. V. fingers at 1 mm. Three out of the 5 children of the second, healthy brother were reported to have poor vision and nystagmus, but could not be examined.

Anatomic investigations of coloboma of the macula, especially by Seefelder, do not support the assumption of an inflammatory origin. Most likely it is the final stage of different disturbances. Schott is inclined to explain his case according to Elschnig's theory, by a localized proliferation of both layers of the secondary ocular vesicle at the posterior pole, an active process of the ectoderm, by which the normal development of the derivations of the mesoderm are damaged, such as represented by the completed malformation.

Lawson reports a large bilateral coloboma of the choroid and disc in a man aged 31 years. The lower limits of the enormous coloboma cannot be seen in either eye. On the left side the fovea appears to be engaged. The sight is bad and there is nystagmus. Vision R. 1/60; L. fingers at 1 foot. Both eyes myopic, R.—10 D.; L.—17 D., not materially improved by glasses.

Waardenburg reports heterochromia, which he thinks generally exists with unilateral sympathetic affection. This sympathetic heterochromia must be sharply distinguished from heterochromia with cataract, descemetitis and vitreous opacities (von Herrenschwand) but does not need to be distinguished from heterochromia with other changes (Scalinci Streiff). Waardenburg has observed up to the present time 73 cases of uneven color of the iris; 37 partial heterochromia; 5 unilateral melanosis. The other 31 cases of complete heterochromia—in 8 there were no other anomalies, in 6 congenital anomalies were found, tabes in 2, and in the other 7 sympathetic paresis.

A congenital colobomatous defect of the iris stroma, sphincter, and retinal pigment layer is reporteed by **Kafka.** **Koby,** with a study of the literature relating to it, reports a case of heterochromia in a woman of 27, the right being blue and left brown. He agrees that pigmentation of the iris stroma is a dominant character in the Mendelian sense.

Fernandez briefly reports a series of observations on this condition.

Toulant has described 8 albinos with various other ocular defects; and **Svestka** has written on a rare form of albinism.

The patient of **Stajduhar** showed bilateral microcornea, embryotoxon, congenital melanosis corneae, and *hypoplasia of the iris.* On the right side there was polycoria; there were two nasal reacting, and one temporal nonreacting pupils, and a small, cloudy lens. On the left side there were partial irideremia, partial clouding of the lens in the anterior cortex, and normal retina and papilla.

In one case of total congenital *aniridia* with cataract and deposits of lime, **Clausen** could not ascertain heredity, but did in 2 children of another family, with total congenital aniridia, calcareous cataract, glaucoma and nystagmus. The father also showed aniridia and out of his 8 brothers and sisters, 7 had total congenital aniridia. Clausen demonstrated another family, illustrating the extraordinary heredity of this anomaly, viz., a mother and a son, one brother and two sisters of the mother. The brother presented in the lower portion of the atrophic iris oval lacunae, in which the stroma was lacking and the pigment epithelium completely exposed. One sister had a congenital bilateral coloboma downward, with cataract, the other bilateral almost total aniridia, with posterior cortical cataract, excepting a very small stump of root of iris upward and inward. The paternal grandfather and his brother had aniridia, but out of the 3 children of the brother, only the son had inherited aniridia, transmitting it to all his 4 daughters and one of his 3 sons. One of 3 sons of one daughter had aniridia, while her two daughters and the two other sons had healthy eyes.

The cases show, that in aniridia there is in the first place a formation of coloboma or a lack of the mesoderm, i. e., the stroma of the iris. In the cases of partial colobomas of the iris, the pigment epithelium was macroscopically perfectly intact. The vision obtained in some patients of 1/4 even 1/2, after operation of the cataracts, seems to argue against the opinion of others that aniridia with cataract is chiefly due to ectodermal malformations, and that in these cases almost always an anomaly in the central retinal fovea exists.

Holm examined, after death, the eyes of a child, aged 1 1/2 years, with bilateral aniridia and nystagmus. The father also had aniridia and poor vision, divergent alternating strabismus, rotatory and horizontal nystagmus, small eyeballs, anterior and posterior polar cataracts, opacities of the equators of the lenses; and a sister of his had similar changes.

The eyes of the child were hardened in formalin. An equatorial section showed the orbicularis ciliaris wider than normal, the corona ciliaris well developed. The lens was very small, and a considerable space between the lens and the ciliary body showed the back of the narrow iris, which extended to the border of the lens.

The retina exhibited a typical fold with a deeply colored macula, but no fovea centralis. This is not an unusual condition in aniridia and may explain the nystagmus and impairment of vision. The lens was clear, and the angle of the anterior chamber free and normal. This condition in such a young child seems to indicate that cataract, glaucoma, etc., are secondary changes, due to faulty shading of light, and that the rudimentary iris in consequence of the missing sphincter may assume a faulty position and occlude the angle of the anterior chamber.

PHYSIOLOGY.—Under the title biology of the ciliary epithelium, **Heine** has described its relations to the development and regeneration of the zonule, its relations to Descemet's membrane, the formation of a horny layer, the rosettes and buds connected with it, the swelling and its relations to tumor development. **Luna** writes on pigment cells of the choroid as cultivated in the test tube. **Langley** has discussed the nature of cells in the nerve plexus of the iris. **Nicati** discusses the contraction of the vascular choroid and the tension of the eyeball.

The innervation of the iris, its motility, its reactions and behavior under the influence of collyria are discussed in detail in **Magitot's** book. **Wessely** has experimented on the iris dilatator which was caused to contract by electrical stimulation of particular sectors of the iris in cats and rabbits. The convulsive vermicular contractions of the iris have been studied by **Guist** with the slit lamp and corneal microscope.

SENILE CHANGES.—**Hinnen** examined the conjunctiva, cornea and iris of the healthy eyes of 462 persons of from 6 to 85 years, arranged in tabular form, with regard to senile changes. Changes of the iris, pupillary margin and retinal pigment layer were lacking in earlier years, became more frequent with increasing age, and in the older patients were encountered in almost all cases.

Peters reiterates that high intensities of light may directly injure the iris and the nerves of the iris, causing pain. The common glaring pain due to natural daylight depends on the pupillary contraction, and is bound to a latent or apparent condition of irritation of the 5th nerve, which can be alleviated by medical treatment.

UVEITIS, ETIOLOGY AND PATHOLOGY.—A study by means of complement fixation on the serums of patients suffering from injury and disease of the uveal tract, and on the serums of dogs given vitreous injection of pigment, and wound of the ciliary body of one eye, has given **Woods** these results:

Injuries of the uveal tract allow the parenteral absorption of uveal pigment. The normal reaction of the organism is to develop an immunity to this pigment, which not only leads to the normal healing of the wound, but also protects against further absorption of the pigment. The failure to develop this immunity is accompanied by the persistence of the inflammatory reaction, and the liability of the organism to sympathetic ophthalmia. In cases of sympathetic ophthalmia, it appears that an actual hypersensitiveness to pigment occurs.

In dogs failing to develop this immunity, further absorption of pigment leads to the development of the ocular inflammatory symptoms. This ocular inflammation is not confined to the wounded eye, but is bilateral, is apparently an anaphylactic iridocylitis, and may represent sympathetic ophthalmia as manifested in the dog. In disease of the uveal tract, with the exception of retinitis pigmentosa, no parenteral absorption of uveal tissue takes place. In retinitis pigmentosa a low grade immunity to uveal pigment appears to be constantly present.

One of **Benedict's** experiments seemed to show that similar attacks of iritis may occur in the rabbit, and that the organisms isolated from a focus of infection during an acute attack, or an exacerbation of chronic iritis, are more prone to localize in the iris and produce inflammation than those taken from persons who have not suffered from acute attacks of iritis for a number of years. Iritis was produced in the rabbits whenever injected with a culture taken from a person having an acute iritis, but was in no instance produced when inoculated with organisms taken from persons whose eyes were not acutely inflamed. He was convinced that the streptococcus viridans was the organism that produced the lesions in the rabbits, and that the staphylococcus was harmless.

He concludes that iritis is produced by bacteria arising from foci of infection around the roots of teeth and in the tonsils, that it is an inflammatory reaction brought about by the presence of bacteria in the tissue of the iris thru the blood stream from the foci of infection. Iritis caused by bacterial infection seems to be an inflammation of muscle tissue at the place corresponding to the parts of muscles affected in rheumatic affections of the limbs and trunk. He therefore concludes that iritis of focal infection origin is a myositis, caused by an organism that at some period of its growth may cause iritis, and at other periods inflammation of some other muscle. This affinity for iris tissue becomes a function of the organism spontaneously, or may be acquired by growing on iris tissue, is easily lost by the organism when grown in different environments, and it will change its affinity for special structural tissue or even lose its virulency to a marked extent.

Heine discusses the objective and subjective symptoms of chronic endogenous uveitis, a picture, clinically and anatomically described by **Fuchs**. As the terms iritis, cyclitis, choroiditis, retinitis, designate only what can be clinically ascertained at certain moments, and the process shows a much larger extent, if such an eye comes to anatomic examination, Heine proposes as a better name chronic endophthalmia. Aside from the three well known causes, viz., syphilitic, tuberculous, sympathetic, one must also think of all pathogenic germs that also cause acute endophthalmia, as staphylococci, streptococci and diplococci. If the chronic uveitis in this sense is considered as a constantly relapsing metastatic ophthalmia, one must look for the focus, from which the invasion of the blood current takes place. This is considered from osteitis in the neighborhood, nose, ear and teeth, to the affections of other organs. He concludes that the endophthalmia, especially chronic, is caused by true infection, not by intoxication and not by postinfection intoxication.

From the fact that many uveal manifestations cleared up quickly following removal of some well defined focus of infection, **Black** would be inclined to accept the toxic theory. Those cases which did not improve, or at least not in proportion to the improvement made in the accompanying malady, would indicate that the irritating factor in the uveal tissue was of a more tenacious character than a toxin and might be bacterial.

Gifford finds that the cases, due to focal infection, showed an affection of the anterior layer of the iris with synechiae, involving only the pigment epithelium, and seldom showed any formation of nodular infiltrates. Cases due to lues and tuberculosis showed lesions of the deeper layers with broad synechiae including iris stroma. Nodule formation occurs in most cases, in many of which it could be seen clinically. The larger nodules of each disease were usually clinically distinct, and cases of tubercular uveitis without demonstrable tubercles were relatively rare.

Abelsdorff emphasizes that primary iritis, i. e., not elicited by affections of other parts of the eye, always demands examination of the whole organism. Aside from the acute infectious diseases, as typhoid, relapsing fever, etc., which only exceptionally come into consideration, rheumatism, gonorrhea, gout, diabetes, lues and tuberculosis play in the first place an etiologic role. There is, however, frequently relapsing idiopathic iritis in otherwise healthy persons, in whom at least the present examination cannot ascertain an alteration of the whole organism. Iritis occurring after the 40th year is always suspicious of gout. Gouty iritis is characterized by very acute onset, great pain and inclination to relapses. Diabetic iritis has a tendency to formation of exudates and pus, but generally takes a favorable course.

Daulnoy observed, 4 days after the beginning of a cerebrospinal meningitis in a child, aged 15 months, an hypopyon of the right eye, which disappeared within 3 days under treatment with meningococcus serum. The lumbar injections were continued for 2 weeks and the meningitis receded, followed a week later by a relapse with iridocyclitis. With general paralytic symptoms, the child died after 4 weeks.

Procksch saw in the course of multiform exudative erythema catarrhal conjunctivitis, after 2 weeks keratitis, and 5 days later bilateral fibrinous superficial iritis with precipitates and synechiae. The eye affection subsided 5 weeks after the onset of the exanthema, leaving remnants of corneal infiltrations and precipitates. **Dor** reported 3 cases of severe iridocyclitis in young girls, due to abundant leucorrhea, terminating in phthisis.

W. C. and **W. M. Bane** presented a woman, aged 43, with uveitis of both eyes, of uncertain origin. Under atropin, hot applications, calomel and aspirin, finally mercurial inunctions twice daily, the greatly diminished vision did not improve, altho the patient became gradually more comfortable. Roentgen rays of the nasal sinuses and Wassermann were negative. The right tonsil showed a slight path of exudate, cultures from which were negative. Black, Jackson and Finnoff advised an explanatory operation on the nasal sinuses, as it was impossible to be sure that the sinuses were normal, and the patient looked as tho she were in danger of blindness.

Crane reported 2 cases of iritis in which the infection of the nasal sinuses was the dominant source in one, and the sole source of the rheumatism and iritis in the other.

Olmstead reports 5 cases of focal infection, partly from teeth, tonsils and intestines. He feels that those cases that we can ascribe to an intestinal origin arise from the products of infections from the teeth, tonsils or accessory sinuses, that are swallowed repeatedly with the food, or from the ingestion of improper foods that the stomach and intestinal tract cannot properly digest. The errors of diet and resultant digestive disturbances in relation to diseased conditions of the eye are due to the vast amount of carbohydrates that are consumed by most people. They produce sugar fermentation, by the acid of the bacteria present. Hyperacidity and acid stools result, and the toxins produced are carried to distant parts of the body and do their nefarious work. Dietitians are not all agreed as to the value of sugar, and Olmstead believes we should look upon it as a toxic substance, and that both adults and children should be deprived of its use, as far as possible.

W. C. Bane presented a man, aged 63, whose right eye had been injured in 1892 by a glancing blow from a large piece of steel, with resulting cataract. There had never been any further trouble until October 1920, when the patient was referred to Bane with iritis and exudate in the anterior chamber, and an old horizontal corneal opacity. All teeth had been extracted more than a year ago. In spite of all kinds of treatment, there was severe pain off and on, and the exudate had since increased. Crisp thought that there might be a calcareous or partial osseous degeneration of the uveal tract, and Magruder favored removal of the useless eye.

A strong man, seen by **Kayser**, suffered in 1900, when 33 years old, from opacities of the vitreous of both eyes, which gradually increased. From 1904 to 1906 he was in the clinic of Prof. Axenfeld, with fine dust like and filamentous opacities; irides free, but pupils did not readily dilate under atropin. Wassermann negative, tuberculin test positive; energetic inunction cured. From 1906, the patient was under the care of Kayser. Without acute irritation, the chronic uveitis continually progressed. Synechiae and nodules at the pupillary margin formed, and the vitreous became more opaque. Hypopyon occurred at constantly shorter intervals, and finally atrophy of the optic nerve, so that in 1913, the patient was amaurotic. From 1911 on he suffered from attacks of severe pain shooting from the feet to the head and eyes, stopping with the appearance of hypopyon. Up to his death in 1918, they were constant and very excessive, so that all narcotics were of no avail, with frequent chills. There was no gonnorrhea or gout. The whole clinical aspect argued for protracted sepsis. This case also showed the bad prognosis of endogenous iridocyclitis for the eyes and life. Only in the early stages, as long as the body has some powers of resistance, treatment may have some effect.

Lippmann examined 95 patients from the clinic of Prof. Elschnig, 117 eyes, affected with iritis. In the large majority of cases with functional disturbances from iridocyclitis, the cause of these disturbances was found in the retina. The predominance of the defect of the blue-yellow perception over that of red-green, or the exclusive existence of the former is a certain proof of the primary lesion of the retina. Degeneration of the optic nerve is a final sequel if the retina is living and intensely damaged. In cases in which the iridocyclitis is slight and the diffuse retinitis considerable, the process in the anterior and posterior segments may be attributed to a common noxious substance circulating in the blood. If the retinitis follows iridocyclitis, probably the disintegration of the products of uveal tissue and exudation, i. e. in the widest sense of the word cytotoxins, diffusing thru the vitreous, create the retinitis. This explains why the primary disease is localized in the retina and not in the optic nerve. The predominant injury of the fovea may be due to the fact, that here the neuroepithelium almost freely borders on the vitreous, and the removal of the matter is impeded by its avascularity.

Schmelzing reports 3 cases of anterior uveitis connected with acne and furunculosis. **Vasek** reports iridocyclitis with chronic parotitis. **Frede** writes on malarial iritis.

Examination of both eyes in a case of purulent iridocyclitis showed **Gilbert** a uveal focus of inflammation limited in both eyes to the point of transition of the ciliary body to the choroid, breaking thru the hyaloid membrane with extension into the vitreous, leading to induration and detachment of the retina. It may be assumed that relatively early the posterior parts of the pars plana become involved, with damage of the hyaloid membrane in the region of the posterior end of the ciliary extension of the involvement from this point to the vitreous, the inflammatory process being limited posteriorly by the retina, while anteriorly the extension of the process directly into the anterior chamber is simplified. The character of the cells in the involved areas is interesting, the absence of leucocytes being conspicuous. It is also assumed that there is a localized eosinophilia rather than a generalized eosinophilic condition, and it is certain that the eosinophils are drawn from the blood and are not of local origin. **Kleinsasser** discusses visual field disturbances in iridocyclitis.

Wilder thinks that uveitis is insidious in its onset, manifesting itself as a low grade inflammation of any part of the uveal tract. It may not be noticed until the exudate into the vitreous and anterior chamber clouds the media and obscures vision. Pain may be absent if the choroid is the part chiefly affected, as this part of the uveal tract is devoid of sensory nerves. One of the most constant manifestations in uveitis is the presence of deposits on the posterior surface of the cornea, and opacities probably of a similar substance in the aqueous humor and vitreous. As expressed by Nettleship, the largest of these look like "minute drops of cold gravy fat, the smallest like grains of grey sand." Wilder concludes that uveitis is no more than iritis or an iridocyclitis of a socalled serous character with involvement of the choroid, particularly the anterior portion. It is mild as a rule, but in its severer forms might prove as disastrous as sympathetic iridocyclitis.

McGuire saw a girl of 16, with severe iritis and vitreous opacity, the vision of whose right eye was reduced to light perception. All usual tests and two months treatment failed to throw light on the case or give relief. It was then discovered that the attack had commenced with one of severe pain in the right iliac region. Careful reexamination led to a diagnosis of chronic appendicitis. Much persuasion induced her to submit to appendectomy. The appendix was found filled with pus. Vision immediately began to improve and in six weeks was normal. There had been no recurrence in eighteen months.

Ramsey reports cyclitis with parotid swelling. The patient was an unmarried woman of 31, who had enlarged cervical glands removed at the age of 6. After hard work eyelids became puffy and swollen. In the third week the parotid gland began to enlarge, and four weeks after that the sight of the right eye became dim, with pericorneal injection with numerous spots on the posterior surface of the cornea, discoloration of the iris, irregularity of the pupil. V.R. 6/12; L. 6/18; but in a few days she could scarcely distinguish hand movements. With the administration of thyroid extract she got well.

Gilbert reports nodules in the ciliary body in connection with erythema nodosum.

Arens reports metastatic puerperal ophthalmia of pneumococcus origin. **Stilwill** and **Black** report recurrent iridocyclitis in a woman aged 62, who had been under the care of a starvation specialist and much reduced in weight. Tuberculin treatment and thyroid extract had been used without benefit. **Allport** reports intense iridocyclitis with double choroiditis in the case of a woman aged 60 years, who desired operation of cataracts. This was successfully done, altho a prolonged and stubborn iritis followed the operation. The ultimate result was clear black pupils, vision with glasses 20/40, J. 2.

Lewis reports two cases of iritis in patients who had been handling cows with inflammations of the eyes. It would be worth while to have bacteriologic tests made in cases of like character. **Herrenschwand** has written on the treatment of gonococcus iritis.

Buck reports partial recovery in uveitis with intense vitreous opacities in a man aged 23. The treatment consisted of atropin and dionin locally and hot applications; subconjunctival injections of salt solution, and internally he was given increasing doses of potassium iodid. Mercury was administered by inunction; he was given pilocarpin sweats and hot packs. This treatment was continued for several months. From vision of hand movements for over a year it was ultimately recovered in both eyes to 8/10.

Meller shows, that the question as to retrobulbar neuritis complicating chronic endogenous iridocyclitis can, at least partly, be satisfactorily answered by anatomic pathologic findings. They prove that the morbid process may be conveyed from the anterior uveal segment into the perivascular lymphatic spaces of the retina behind the lamina cribrosa, where it may exert its deleterious influence, without eliciting ophthalmoscopically visible changes at the disc. Others, e. g., Gilbert, attribute the retrobulbar affection to a primary hematogenous localization of the disease. To show how far primary degenerations may be utilized for the explanation of the visual defects, further anatomic pathologic researches are necessary, especially of recent cases of iridocyclitis, which, however, are rarely available. The clinical examination will hardly be able to determine with certainty the differential diagnosis.

CHOROIDITIS.—**W. C. Bane** presented a boy, aged 16, with chorioretinitis in the right eye. Vision became suddenly very much blurred, 5/60. A marked retinitis extended very slightly beyond the disc. There was a trace of albumin in the urine. Two weeks later the swelling of the disc was more marked, media somewhat hazy, and there was a gray swelling of about a disc diameter at the macula, with a dark spot in the center. After a fortnight, the macular lesion consisted of an oval gray membrane with notched edges, and smaller than the disc. The membrane was to the temporal side of the fovea. When the pupil was again dilated, a ring of deposit was found on the anterior capsule of the lens.

Strickler exhibited a woman, aged 35, on account of an obscure disturbance of vision without definite fundus changes, the underlying cause being possibly a multiple infection of the nasal accessory sinuses. A dentist, disregarding the wishes of the physician, had limited treatment to irrigation of the antrum thru an opening in the alveolar process. The vision was not better and there were now definite areas of choroidal disturbance. The antrum still gave a shadow on the Roentgen ray plate.

Tyson exhibited a baby, 13 months old, with bilateral metastatic choroiditis, following pneumonia, with which he had been ill for 2 weeks. His eyes were red, and after one week the pupils appeared white and the child could not see. Previous to the illness the child enjoyed good health and apparent good vision. Vitreous filled with yellow-white exudate, posterior synechiae. irregular pupils, periphery of iris retracted, tension slightly diminished, circumcorneal injection.

Baldino reports the case of a man of 25, who was almost blind from progressive iridochoroiditis in both eyes. Three and a half years before, iritis developed in both eyes with especially severe premonitory symptoms of headache. At that time, one Wassermann was positive, but the disease resisted treatment by mercury and potassium iodid and when it finally subsided, he was left with vision of hand movements in both eyes. Optical iridectomy was performed on the right eye with little effect. When first seen by the author, Wassermann was negative and the eyes were quiet. A bilateral symmetric patch of complete loss of pigment was noted on the skin at the inner angle of both upper and lower lids. The cilia were white in this region and very fine. Patient stated that this condition developed a year after the iritis.

The existence of this patch of vitiligo indicates an involvement of the sympathetic system supplied by certain branches of the first and second division of the fifth nerve. Similar cases of vitiligo from lesions of the sympathetic and especially of the sympathetic components of the fifth nerve have been reported. The reported cases of iridochoroiditis associated with heterochromia iridis, alopecia areata and other diseases of a sympathetic origin are reviewed in their bearing on the present case. Cases of uveitis associated with vitiligo have been reported by Erdman, Komoto and Gilbert. There seems no doubt that in this case, the association was more than a chance occurrence. The author concludes that in cases of uveitis where none of the usual causes are found, it is important to search for evidences of endocrino-sympathetic instability.

Peter discusses the obscure forms of posterior uveitis, their relation to sinus disease and especially the lessons to be learned therefrom. He cites the case of a man, aged 35, who has suffered recurring attacks of uveitis alternating between his two eyes, studied for three years before a confirmed diagnosis was made. An old tubercular process treated with tuberculin did not clear up the trouble. X-ray examination of the sinuses seemed to furnish evidence that a toxemia might be lodged in the sinuses. Finally invasion of the left macula gave unmistakable evidence of a localized field of pathology in the left optic nerve. Careful examination revealed well advanced disease of both sphenoid and ethmoid. Operation confirmed the diagnosis. Peter thinks that sinus disease should be seriously considered as a cause of obscure uveitis, that eye conditions of tubercular origin will not respond to tuberculin treatment until the posterior cells have been thoroly opened and drained, and that there should be team work in the management of sinus diseases.

Polack and **Frogé** presented a woman with two daughters, who showed some of the evidences of proliferating retinitis, the vessels being abnormally large and tortuous. The cause was not evident. But congenital angiogliomatosis of the retina was suggested.

Lievens reviews the literature and reports a case of punctated and pigmented chorioretinitis albescens occurring in a man, one of 16 children, only one of whom had visual disturbance. No consanguinity. The papilla was of a pale rose color on the nasal side; on the temporal side a greyish-white mixed with yellow, waxy; scleral ring a brilliant white, lightly veiled. Retina more or less opalescent in the neighborhood of the disc; intravascular spaces a more or less pale grey, covered with discreet small punctate spots; in every part of the fundus these "albescent" spots. The white spots had somewhat the appearance of the plumage of the guinea fowl. The more pigmented the intravascular spaces of the choroid, the more apparent the white spots. With the upright image their dimension was about that of the head of a pin. Borders were irregular and when confluent seemed festooned. Scattered among these were a number of small pigmented spots.

Weisenberg reports a peculiar case of acute chorioretinitis with yellow discoloration of the macula.

Story reports keratitis punctata in a woman, aged 22 years, who had the right eye enucleated, and now had a similar condition clinically in the left, with vision of 6/60. He had tried all the usual methods of treatment without result. In discussion, Crawley relied mostly on pilocarpin, hot baths, and constitutional treatment. Werner sought for some source of endogenous infection, and quoted cases where he had seen good results from vaccines. He considered these cases bore a strong resemblance to sympathetic ophthalmia. He would suggest the use of paracentesis, subconjunctival injections of saline solution, and some of the arsenobenzol preparations.

Ellett presented a young lady with exudative choroiditis and fine vitreous opacities, of one week's duration, the cause being as yet undetermined. There were fresh choroidal exudates up and in from the disc, and beyond them a pigmented area, probably the scar of a previous attack. Vision was slightly reduced. Also in **Krauss'** patient, a large, robust man, aged 21, apparently in the very best of health, the cause was obscure. Wassermann negative, but von Pirquet positive. He had clouding of the vitreous, with a large mass of exudate in the upper portion of the choroid. As the exudate absorbed, choroidal changes remained. Much improvement followed the use of iodid of potassium. **Goldberg** again exhibited his case of choroidal exudate simulating a foreign body. The pigmented area was more sharply defined, and the exudate more completely absorbed, so that it really had more the appearance of a foreign body than when at first seen. The eye showed no signs of inflammation, and vision had improved to within one line of normal.

Hanssen found that the changes of the retina in nephritis are not always uniform, but that important reasons favor the conception of the whole aspect as independent inflammation. This is supported by the undoubtedly inflammatory alterations of the choroid. Frequently the poison attacks the kidney and the eye; in another group, the retinitis is elicited by metastases from the diseased kidney.

Kuemmell attributes the cause of detachment of the retina to changes of the whole uvea, infiltrations and degenerations. Since the employment of the tonometer, almost all cases of detachment, even very recent ones, showed hypertension. As the pressure in the choroidal vessels is greater than the intraocular, a transudation from these will occur, loosening the connection between retina and choroid. He calls attention to the difference of the postretinal fluid from the vitreous by its high content of albumin and its greater specific gravity, which makes it sink downward. "As the vitreous and the lens are dependent upon the uvea for their nutrition, the production of fluid for the vitreous will suffer with subsequent decrease of tension and degeneration of the vitreous and retraction. As the vitreous is intimately connected with the retina, this will follow its retraction. That the pressure behind the retina is greater is shown by the inward turns of the edges of the retinal ruptures. The complications of detachment of the retina, as iridocyclitis and cataract, are only further development of the original affection of the uvea.

Syphilis.—**Lauterstein** and **Planner** report on the intracutaneous injection of organ luetin, devised by Fischer. This consists of an extract of the lungs, liver, spleen and glands affected with pneumonia alba, of hereditary luetic fetuses, which contain abundant spirochetae. Positive reaction was found in all luetic eye affections.

In a comparative study of syphilis in white persons and negroes, **Zimmermann** found a marked difference in the frequency of iritis in the 2 races. Both in early secondary syphilis and subsequently in the course of the disease, the negro is more liable to iritis than the white man. It occurs in more than 10% of all cases of early secondary syphilis in the negro, and is most often associated with follicular syphilis. Abnormalities in the cerebrospinal fluid of partially treated syphilitics with iritis occur with no greater frequency than in the fluids of treated patients who have not had iritis.

In order to determine the significance of syphilis as an etiologic factor in acute iritis, **Clapp** tabulated his last 87 cases of clinic and 13 of private practice. In 82.4% of the former and 69% of the latter, the spirochetae were the chief etiologic factor. In making the diagnosis of syphilitic iritis 3 very important points are to be considered: 1. Wassermann reaction, 2. the presence of condylomata, 3. the therapeutic diagnosis. According to this investigation, syphilis is the etiologic factor in about 80% of acute iritis cases. About two-thirds of the cases are male. 8% show condylomata of the iris. The average age is about 33 years.

Rumbaur adds a new case to the 4, histologically described, of primary iritis in congenital lues, in a girl, aged 24 years. Both eyes were moderately irritated, diffuse opacities of both corneae, iris dirty grey and hyperemic, in the left some small yellowish greyish mass in the pupillary area, anterior chamber shallow, tension increased.

Iridectomy. After 13 days eyes showed inflammatory symptoms. The right eye remained well, but new exudations and adhesions occurred in the left eye with subsequent hydrophthalmus.

The excised pieces of the iris showed diffuse chronic inflammatory infiltration of the whole tissue with lymphocytes and plasma cells, and transition into cicatricial sclerosis, without essential involvement of the blood vessels. All the other cases showed this lack of vascular changes, which is distinctly different from acquired lues. As the vascular system is the tissue of the human body which has the most active function, Rumbaur thinks the less used up vessels of young children are more resistent to the invasion of the luetic virus.

According to **Abadie,** the forms of chorioretinitis due to exogenous infections have a tendency to get well, while those of endogenous origin recur more frequently and become graver. They appear chiefly in middle life. They are usually of syphilitic origin, hereditary or ancestral, affecting only the deeper membranes as a rule. The appearance of the fundus varies from small, numerous circumscribed foci to large white islands, sprinkled with numerous patches of pigment. Sometimes the disease involves the optic nerve causing atrophy. The appearance of the disc is characteristic. It is grayish, with ill defined borders, and the arteries and veins are filiform, due to thickening of their walls. Chronic simple glaucoma and congenital hydrophthalmos are also complications or sequels. Detachment of the retina is a more frequent result, and even in myopia, foci of retinochoroiditis will be found in the equatorial region, which certainly play a role in this condition.

Wallace reported the case of a negro boy with tuberculous iridocyclitis. In discussion, Finnoff thought the condition in the right eye was syphilitic, as there was a collar of induration below the right cornea and the fundus lesion was suggestive of syphilis, altho the infiltration in the cornea suggest tuberculosis. The condition in the left eye is tuberculous, and tuberculin treatment was indicated.

Wallace reports chorioretinitis in a woman aged 24 years. The right fundus showed an area of white and black patches upon a grayish background extending 5 d. d. to the temporal side of the optic disc. There was a floater in the vitreous. The left fundus showed large areas of atrophy. The condition was thought to be tubeculous, syphilitic, or due to focal infection.

Ganguly reports the case of a man, aged 36, who had been treated by general physicians for syphilitic keratoiritis in the left eye. Morphin and aspirin had temporarily relieved the pain, but as sight was reduced to light perception enucleation was advised but refused. The patient disappeared for six months, and upon his return Ganguly found the sight with correction was 6/12 with only a slight corneal opacity remaining.

Terrien reported a case of syphilitic chorioretinitis in a man of 56, who had lost all phalanges of both hands (Morvan's disease).

A patient of **Susuki,** a man, aged 46, with glaucoma simplex, showed excavation and marked white choroiditic foci. Wassermann strongly positive.

Blatt observed a gumma of the left ciliary body of a man, aged 40, 11 years after infection. The cornea had an opaque hue, the structure of the iris was indistinct. At the upper sinus of the anterior chamber was a yellowish vascularized, round nodule, 3 mm. of which were visible, bulging the iris forward. Three millimeters above the upper limbus there was a dark bluish prominence of the thinned sclera of the size of a bean, very painful on palpation. Thru the enlarged pupil a greyish yellow mass appeared above, behind the iris. Vitreous intensely opaque. V. fingers at 1/2 m. Under mercurial inunction and intravenous injections of neosalvarsan, the patient was cured in about 2 months. V.—5/15. This unusually good result is ascribed to the favorable action of neosalvarsan.

TUBERCULOSIS.—A boy, aged 8 years, presented the aspect of a right typical nodular iritis with hypopyon, dense exudations in the vitreous. No red fundus reflex. V. counting fingers at 1 m. Diagnosis: uveitis tuberculosa. After 8 months enucleation. Serial sections revealed undoubted glioma retinae. Within 2 years no relapse. **Meisner** never saw tuberculous iridocyclitis in children, and considers this as an important point in the differential diagnosis. Such a picture in children under from 10 to 12 years never indicates tuberculosis.

Key reported relapsing uveitis in the left eye of a man, aged 23, starting almost from the time of injury of the right eye by a penetrating nail, 2 years ago, which necessitated enucleation of the injured eye. Two years after the accident, the left eye presented the typical picture of low grade plastic uveitis. X-ray plates of the sinuses and teeth were negative. Old tuberculin gave a local and general reaction. Hot bathing and atropin and injections of T. R. every 4 days brought about a gradual recovery. V. 20/25, fairly clear vitreous, the fundus showing a general moth eaten appearance, the ravages of a low grade disseminated choroiditis. In spite of continued home treatment and light work on a farm, numerous relapses occurred, reducing vision to 20/200. Key considered it as tuberculous uveitis, in which treatment must be extended over a long period of time, excluding the probability of a hidden focal infection, and certainly syphilis, sympathetic ophthalmia, and a dietary or gastrointestinal condition. The teeth could also be excluded.

Carvil gives a detailed clinical history of bilateral tubercular iritis in a woman, aged 41. There were numerous deposits on Descemet's membrane, some pin point and more numerous near the angle of the anterior chamber in the lower half, others larger and lardaceous looking. Two grayish brown nodules on the anterior surface of the iris. Many opacities of the vitreous, fine and large. No ophthalmoscopic view. Pupils bound down by posterior synechiae. V. L. 20/200. Local and general reaction to old tuberculin. Under regular tuberculosis regime in the country and injection of tuberculin twice a week for 3 months, the patient gained 30 pounds, the posterior synechiae were broken and the opacities of the vitreous cleared up. V. R. 20/20. **Gilbert** saw a case of acute choroiditis with benign tuberculous meningitis.

In a woman, aged 22, with tuberculous iridocyclitis, **Thompson** saw a yellow mass in the anterior chamber, iris covered with yellowish exudate, anterior synechia above old exudate filling the pupillary space, marked reaction in each eye to subcutaneous injection of old tuberculin. In the course of a few weeks, under rest, proper diet, tonics, local treatment and several injections of old tuberculin, the patient's general health improved, the right eye became distinctly clearer and the left eye showed a marked decrease in the large amount of exudative material.

Curtin reported a case of solitary tubercle of the choroid in a girl, aged 13, with a grayish white mass adjacent to the disc with an elevation of 3 D. V.=20/200. The subcutaneous tuberculin test gave a moderate reaction. After tuberculin treatment for 5 months, the mass was reduced in size. V.=20/70. The patient gained 15 pounds in weight.

Abelsdorff says, that altho tuberculous iritis not rarely heals spontaneously, a tuberculin cure is to be recommended. If cautiously applied, a favorable influence is occasionally unmistakable. It must, however, be conceded that in some cases it does not check the process.

Five out of six cases of tuberculous iritis yielded rapidly and well to Roentgen rays, applied by **Jendralski.** Only one, with a large solitary tubercle, did not respond.

Weigelin reported his experiences with tuberculin treatment of iritis serosa with chronic iridocyclitis without typical tuberculous signs (27 cases), disseminated choroiditis (16), typical tuberculosis of iris, nodular iritis, granuloma of iris and ciliary body, choroidal tubercules (22), observed for from 3 to 15 years, starting with 1/1000 mg. old tuberculin, increased every 2 or 3 days by 1/1000, then 1/100, 1/10, until transitory improvement was attained, without prevention of relapses. An attempt with tuberculin seems justified in all cases of ocular tuberculosis, with frequent repetitions, as by cautious application no harm is done.

TREATMENT.—**Doherty** demonstrated on 2 illustrative cases the rapid and brilliant action of atropin, used subconjunctivally, in dilating the pupil and reducing tension in iris bombé, with increases of tension, in which instillations of atropin and the placing of powder into the lower cul de sac had no effect whatever.

Loring stated, that in the treatment of uveitis in general, it was necessary to make an individual etiologic diagnosis, or treat symptomatically: moist heat, dionin, atropin, notwithstanding increased tension, elimination thru all channels. If necessary, an iridectomy should be done with a broad clean base. In gonorrheal cases, it was advisable, in connection with the foregoing treatment, to proceed at once with the treatment by vaccines. In the chronic recurring cases of uveitis of various forms, subconjunctival injections of cyanid of mercury or normal salt solution might be used.

In the treatment of certain forms of iridocyclitis, injections of Coley's toxins, used for the treatment of sarcoma, seem to **Verhoeff** to be of considerable value, but should not be used to the exclusion of other forms of treatment, including especially the removal of any discoverable foci of infection.

The most favorable effect of parenteral milk therapy was observed by **Jendralski** in iritis, especially rheumatic, the alleviation of pain being most striking. In chronic iridocyclitis (3 cases) the treatment was less effectual. According to **Wiese**, it is indicated as support of the specific serum therapy in tubercular and luetic ocular affections. **Abelsdorff** saw very good results from injections of milk or ophthalmosan in obstinate cases. In iritis all elements increasing the cardiac activity and blood pressure must be excluded by rest in bed, diet, regulation of the bowels.

Fukula recommended for the treatment of choroiditis painting the eyeball with sublimate solution 1:4000, after slight cocainization, every third day without touching the cornea. On the other days treatment with from 2 to 5% dionin after previous warm applications.

Abadie's treatment of chorioretinitis, which is usually of syphilitic origin, is intravenous injections of cyanid of mercury, 10 to 12 injections followed by a rest of from 2 to 3 months; then a new series, rest, etc. The results are very good, even in cases apparently hopeless, but the treatment must be carried on for a long time, even years.

Abelsdorff found that salvarsan often remarkably abbreviates the course of syphilitic iritis, more than mercury, without protecting from relapses. For obtaining a firm and flat scar, **Purtscher** irrigates the iris prolapse twice daily with a solution of nitrat of silver and following neutralization with salt solution. The concentration can gradually be increased to 5%.

Würdemann found the use of Pynchon suction pump on the Victor electric apparatus with the regulation cups eminently successful in breaking iritic adhesions. The suction and release occur at the rate of about 150 times a minute. It is used for about one-half minute, the eye looked at and, if no hemorrhage is found in the anterior chamber, used again for a minute, and then again for a minute. It may be repeated the next day. The cornea, being more elastic than the sclera, is pulled away from its base, thereby drawing the iris away from the lens. There were never any bad results, but Würdemann would hesitate to use it when there is evidence of implication of the ciliary body and choroid. **Durverger** had good results by the transfixation of the iris in glaucoma and seclusion of the pupil.

In a patient of **Shields**, a man, aged 39, after a lacerating injury, 18 months previous, the iris was caught in the scar of the cornea, and its nasal half pulled completely across the pupillary area. Light perception was very uncertain. Upon his question, whether an optical iridectomy was advisable, Neeper advised to make a buttonhole in the iris with de Wecker's scissors, which might decide the condition of the lens and what further to do.

The left eye of a girl, aged 7, showed severe iritis with posterior synechiae. At the lower quadrant was a small grey nodule, in which the examination with the binocular microscope revealed 2 fine hairs, apparently stickers of a burr, which had been thrown into the eye 1 1/2 years previously. Thru an incision with the lance shaped knife, **Stargardt** removed the 2 stickers under a magnification of 16 at the binocular microscope. They were 0.33 mm. wide at the thickest place and were very brittle. The brittleness and polarization distinguished them as stickers of a plant from the hairs of caterpillars. The iritis subsided at once and the child made a good recovery.

According to **Abelsdorff**, in some individuals a drop of atropin is sufficient to produce edema and erythema of the lids and violent irritation of the conjunctiva, differing from the follicular conjunctivitis occurring after continued instillation of atropin. Thus it must be supplanted by 1/4% hydrobromic scopolamin.

Blatt reports the clinical histories of 3 cases of syphilitic retinochoroiditis with opacities of the vitreous, and one case of hemophthalmus from an injury by the horn of a cow, treated with punctures of the vitreous. Two of the three first cases, in which both eyes were affected, yielded a remarkable success, by the increase of vision. In the 3rd case, hemorrhage occurred with decrease of vision. The hemophthalmic eye of the 4th case had to be enucleated after the third puncture.

Blatt's experiments on rabbits showed that withdrawal of 0.6 c. cm. vitreous is well tolerated. If only 0.4 c. cm. were withdrawn, the puncture could be repeated without damage every week of a period of 4 weeks. In view of the larger size of the human eye than that of the rabbit, from 0.6 to 0.8 c. cm. may be removed without damage at intervals of 8 days. Removal of more than 1 c. cm. is risky. In synchysis of the vitreous very thin needles must be employed. They are carried a little ways under the conjunctiva and then boldly pushed into the vitreous from the temporal side. A slow insertion may give rise to detachment of the retina and hemorrhages. It is better to await the abatement of inflammatory symptoms before punctures are made. A drop of atropin is instilled and a bandage applied for from 3 to 4 hours. Complications were: vertical deep streaky opacity of the cornea, lasting for 4 days, and a hemorrhage into the vitreous.

Blatt's examinations of the withdrawn vitreous of eyes affected with luetic retinochoroiditis, with positive Wassermann reaction of the blood, gave negative Wassermann reaction.

For the last year, **Rosenstein** treated diseases of the uvea and vitreous with aspiration of the vitreous, as devised by Zur Nedden. He made 42 aspirations in 12 patients, aged from 18 to 48 years, with poor sight, who had previously been treated with the usual methods. In all Wassermann was negative, in 3, with intense inflammation, tuberculin test positive. In these the aspirations were made after abating of the inflammation, and application of atropin ointment, but the opacities remained uninfluenced. Tubercle bacilli were not found in the withdrawn vitreous.

In all patients the vitreous was liquified. Detachment of the retina or other accidents occurred in none. After each aspiration, the fundus was very hyperemic for about 5 days. Regeneration of the vitreous took place within from 6 to 14 hours, and the former tension was restored after 2 days.

To withdrawal of each 0.1 c. cm. vitreous corresponded a hypermetropia of 1.00 D, but after from 6 to 14 hours the former refraction returned. 0.50 vitreous was aspirated at intervals of 4 weeks. The aspiration is a valuable, simple procedure in old traumatic opacities of the vitreous, in disseminated choroiditis, iridocyclitis without visible opacities, and diseases of the retina, and deserves the widest application.

Degeneration and Atrophies.—**Kadletz** found in a case of fasicular nonpigmented sarcoma of the choroid, a calcification of the ciliary processes. There was no detachment of the retina on account of the proximity of the disc and the early chorioretinitis, analogous to the secondary pigment degeneration of Leber.

An atrophic iris, the affected area being a sector which went up and out and down and in, in a patient who at three weeks of age had had smallpox was exhibited by **Mann.** The patient was seen at the age of 58. The iris is so thin in the affected regions that the dislocated and opaque lens can be seen thru.

In **Campos'** case a radial rupture of the atrophic iris occurred without traumatism, in a woman, aged 45. She was sitting quietly, when the sudden pain in the eye and disturbance of vision announced the rupture, confirmed by the blood in the anterior chamber. Campos could not find a similar case on record. A syphilitic basis was possible, and there was a history of influenza and infected glands. Tension normal. **Poyales** reports degeneration of the choroid in myelogenous leukemia.

Cysts.—**Hine** exhibited a woman, who had an implantation cyst for 12 years. In 1908 she had a penetrating wound at the limbus of the left eye from a blow. Iridectomy was done. A month or two later she returned with a pearly looking cyst along the margin of the coloboma. V.=6/6. As she experienced no trouble, Heine proposed to leave it alone. A boy, about 8 years of age, sustained a perforating wound of the cornea and iris 2 1/2 years ago. A traumatic cataract had resulted, for which **Pockley** had done a needling. Now there is a small patch of brown pigment on the margin of the laceration of the iris which appeared to be in the stroma of the iris and split in 2 layers. New vessels run into it, and a slight blush on the temporal side of the cornea indicates an inflammatory condition. It was highly probable that it was a small implantation cyst. In case it should increase in size, Pockley would do a small iridectomy and remove it.

A young man, whose bilateral cataracts had been extracted 2 years ago, returned to **Chance,** because of impaired sight in the left eye and swelling of the globe in the anterior segment. A huge bladder like swelling of the entire superior aspect of the segment was present, in the nasal third of which were 2 or 3 purplish elevations, resembling uveal tissue seen in staphylomas. The distension extended for some distance below the external angle of the extraction cicatrix, which was well within the cornea and seemed to be free of iris tissue. Chance was inclined to regard the case as one of cystic distension of the ciliary body caused by a disturbance of the body and probable inclusion of the lacerated tissues during the healing of the wound after extraction of the cataract.

At the lower nasal quadrant of the left iris of a child, aged 9 months, was a cyst with sharply marked white margins. Its surface, as well as the iris showed numerous blood vessels. It was removed with the surrounding iris. Histologically its wall consisted of several layers of cubic epithelium, the innermost of high cylindrical epithelium, and was surrounded by a thin zone of connective tissue with large blood vessels. The cyst was congenital and observed by the mother a few days after birth, **Koch** considers the portion of the corneal epithelium or a scattered germ of the lens as possible matrix. The cyst also may have represented a supernumerary dystrophic lens, according to the investigations of A Fischl, who found after transplantation of the lens of salamandra maculata under the skin a merely epithelial vesicle as a regressive stage.

Bliedung observed a bulging brown ridge projecting upward and outward, downward, inward and outward over the pupillary ridge seam of the right eye of a woman, aged 53, with bilateral cataract. Below it had 3 indentations. The iris was bulged forward, and the ridge moved with the pupil, advancing a little more on dilatation. Its extension backward could not be ascertained by transillumination. On the left eye was a similar condition. At the extraction of the cataract with iridectomy, the cyst ruptured and collapsed. After 11 months relapse.

Histologically the wall of the cyst consisted of one stratum of pigment epithelium. The case supports the explanation of persisting and distension of the sinus annularis as the genesis of the cyst. Of clinical importance are the possible confusion of intraepithelial cysts with sarcoma and complication with secondary glaucoma. Finally the therapeutic suggestions are enumerated.

CHOROIDAL HEMORRHAGE AND DETACHMENT. — A woman, aged 50, stumbled in the dark, striking the left eyebrow, suffering more or less pain in the eye. Two years later she consulted **Stilwill,** who found V. finger movements to the temporal side only. Tension normal, and pupil reacted normally. There was an elevation, beginning 1 disc diameter to the temporal side of the disc, circular, measuring about 3 or 4 disc diameters. The mass was elevated about 2 D., the edges coming up rather abruptly from the surrounding retina. It was traversed by slightly tortuous retinal vessels. The surface was glistening white, without pigment, and irregular in places. Toward the lower and inner part of the mass were 2 or 3 red spots, resembling minute hemorrhages. Jackson thought it must be a case of chorioretinitis proliferans, commencing with hemorrhage, and finishing with a mass of organized connective tissue.

Fleischer thinks two groups of spontaneous detachment of the choroid must be distinguished: one with hypotension due to disease, and subsequent shrinkage of the volume of the vitreous, and one with hypertension in consequence of the transudation or exudation from congestion, vascular changes or inflammations. He reports a case of the 2d type in a man, aged 35, who suffered from cyanosis of the head, dyspnea and cough, probably due to slight edema of the lungs and chronic insufficiency of the heart. The detachment was characterized by pigment streaks of the choroid. A scleral puncture evacuated abundant clear fluid with flattening of the detachment, but after 5 days the condition was the same as before operation.

Hagen made, within 9 months, a systematic investigation in the eye clinic of Prof. Schiötz on the serous postoperative detachment of the choroid. Besides the ophthalmoscope, he found transillumination the most useful for diagnosis, where the former failed. If around the illuminating point the sclera shows light, it signifies that the choroid is detached from it by serous fluid. He found the detachment most frequent after Elliot's operation, in 41 cases, i. e. 76%, after cataract extraction in 13 cases, 22%, and concludes thus: The escape of aqueous from the opening of the anterior chamber is for the greatest part replaced from the vitreous. If this continues, as after Elliot's operation, or fistula of the cornea, the vitreous must finally lose considerably in volume, so that the pressure on the choroid is diminished and a traction exerted on it, leading to detachment. The gap is rapidly filled with transudation from the engorged large choroidal vessels. It occurs only in older persons with rigid sclera. The youngest patient was 34 years. After closure of the fistula, the choroid was reattached. It lasts scarcely 3 weeks and gives a good prognosis, seldom requiring treatment. Puncture of the sclera is not rational. The pigment streaks that sometimes remain are probably caused by proliferation from the pigment epithelium at the folds at the angle of the detached portion.

Maschler reports a case of persistent detachment of the choroid following trephining in a man of 82, who suffered from simple glaucoma. A study of experimental detachment of the choroid has been made by **Meesmann** on the eyes of rabbits.

Sympathetic Disease

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This section reviews the literature from March, 1921, to April, 1922. For previous references see volume 17, 1921, June, p. 167.

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DIGEST OF THE LITERATURE.

PATHOLOGY. — **Nakamura's** findings are of interest. First; the serum from a guinea pig immunized with the uvea of rabbits, when injected into a normal rabbit, produces no visible change in the eyes. When the uvea has been compressed before the injection, it is followed by very marked ciliary congestion, iris congestion and at times slight plastic iritis in both eyes.

Second; if immunized guinea pig serum is injected into the anterior chamber of a rabbit, there is always plastic uveitis, whereas normal guinea pig serum produces no apparent change.

Third; serum from guinea pigs immunized by injection of vitreous humor of rabbits has the same action when injected into the anterior chamber as serum immunized with uvea.

Fourth; serum from the guinea pig immunized against the crystalline lens of a rabbit or the vitreous of other animals when injected into the anterior chamber causes practically no reaction, as is the case with the normal guinea pig serum.

Fifth; the author advances what he considers a new theory and what he calls "*Autoimmunization* Theory" and says that sympathetic ophthalmia may be nothing but an inflammation of the eyes caused by autoimmunization resulting from cytotoxic uveal antibodies. **Woods'** paper on immune reactions following injuries to the uveal tract has been noticed on p. 204.

Hirsch discusses the difficulty of diagnosing a given condition, as sympathetic ophthalmia, and feels that many so diagnosed are in reality of *tubercu-*

lous origin, and cites cases to prove his point. He reviews the common theories of the disease. In regard to the cases that are seemingly cured by enucleation, he believes that at the time of operation there is a great loss of blood, and that the new formed blood has more antitoxin, and in that way the pain and inflammation are stopped. In the same way he decides that antitoxins may come from the use of mercury, baths, etc. He also cites the case of an injury by a piece of straw with subsequent iridocyclitis and hemorrhages, which were proven tuberculous.

Meller believes cell infiltration along the veins is typical of sympathetic ophthalmia, and shows a specific retinal periphlebitis which points to sympathetic uveal inflammation. In certain cases the cells may extend along the veins into the retina, and in this way reach the retrobulbar portion of the optic nerve. Undisputed proof is only found in those cases where this perivascular inflammation is due to the specific histologic structure, which can be identified as sympathetic ophthalmia of the uvea. A case was discussed.

Fuchs contrasts cases of necrosing choroidal sarcoma and sympathetic ophthalmia, with an eye in which sympathetic ophthalmia was first and melanosarcoma later found in the choroid near the equator. He diagnosed the tumor by the proliferation of large pigment cells along the venæ vorticosæ. Between the tumor and the outer layer of the choroid and choriocapillaries were a considerable number of small nodules of sympathetic ophthalmia inflammation. There was also a secondary adenoma in the ciliary process.

Römer reports a case of a splinter of iron in the eye for four days. At the end of that time, a scleral incision was made and the foreign body removed with a small magnet. The eye was without inflammatory symptoms. Eleven days later, the eye showed Descemet's deposits, synechiae, retinal hemorrhages near the nerve, optic neuritis and decrease of vision. The injured eye showed no inflammation of the anterior segment, but there were fresh areas of choroiditis. General examination including Wassermann, tuberculosis and nose was negative. The injured eye was not enucleated. He contests Schirmer's theory of papillitis by toxin, and wonders whether the course of the disease was favored without removal of the eye. In the second part of his dissertation, he reports the pathologic findings of six cases, in two of which he had the first and second eye.

Redslob examined 660 eyes which had been removed for perforating injury. Of these, two hundred and fifty were enucleated because of fear of sympathetic ophthalmia. Serial sections were made and one in every ten stained. One hundred and eighty of the cases were enucleated in the clinic: 21.2% splinters of steel and 10% pieces of copper. In 10% there was rupture or ulceration of the globe. The age incidence was

0-5	6-10	11-15	16-20	21-45	46-60	61-80
18	40	50	30	54	36	24

Forty-three per cent of the cases were between the sixth and fiftieth year, while only 20% were in those more exposed to trauma. The period between injury and enucleation varied from fourteen days to fifteen years; the majority, however, were enucleated after the third or fourth week. The symptoms leading to enucleation were chronic iridocyclitis, accompanied by photophobia, lacrimation, pain on pressing and more or less irritability. Tension, which was noted in one hundred and twenty-six cases, was normal in seven, decreased in one hundred and eight and increased in eleven.

Pathologic anatomy is considered under two headings: endophthalmitis and sympathetic ophthalmia. In the first he discusses the short period of incubation, with the disease limited to the ciliary body, par ciliaris retinæ and the retina. A cellular exudate and uveitis is most marked at the ora serrata and disc, followed by early detachment of retina with subsequent involvement of the choroid. In two cases there was extension to the sclera thru the emissary veins, even to the extraocular muscles.

Sympathetic ophthalmia involves the uvea, especially the posterior layer of the choroid, with less inflammatory change in iris and ciliary body. In fact, the iris may be free. The lesion is characterized by a nodular, cellular, epithelioid and giant cell infiltration, which later becomes confluent or diffuse.

Two hundred and fifty eyes were examined pathologically without clinical history, and as a result seven cases showed definite lesion of sympathetic ophthalmia, in which the other eye clinically showed involvement either at the time or shortly after enucleation. In one case, trauma was said to be the cause of the other eye lesion, whereas sympathetic ophthalmia was found. In another, which clinically was sympathetic, no histologic change of sympathetic ophthalmia was found. Altogether eight cases of sympathetic ophthalmia were diagnosed in the two hundred and fifty eyes removed for fear of it. These eight cases are considered in full detail both clinically and pathologically. He says that severe injury to a child's eye is more often a proper reason for enucleation than the same type of injury in an adult, and that sympathetic ophthalmia is less common among adults exposed to ocular injury by their occupations.

CASES OF SYMPATHETIC OPHTHALMITIS.—Two cases were seen by **Asmus**, one a healthy male, eighteen years of age, who had fallen striking his right eye, causing a penetrating temporal scleral wound extending to the limbus and filling the vitreous with blood. The other eye had vision of 6/6. He was in the hospital fourteen days when the pain increased, and at the end of thirty-four days there was definite shrinking of the eye. The left eye, vision 6/10 with pericorneal injection, clear disc and dilated pupil. On the thirty-seventh day the injured eye was enucleated, the vision of the other eye having dropped to 6/36. The disc was hazy, and a few days later there were Descemet's deposits. Under sodium salicylat, sodium bicarbonat, asterol, dionin and salt solution, in seven months the vision was 6/6. On the nasal side there were four round, gray areas which later cleared, leaving pale, nonpigmented spots which, however, at the end of a year had almost disappeared. Vision was 6/6 and only a few areas persisted in the choroid in the upper, outer part of fundus.

The second case was also a male of eighteen, who was struck in the left eye with a piece of brass, causing a perforation to the nasal side of the limbus and sclera and producing a cataract. The other eye vision 6/6. While in the hospital, the wound healed and there was only slight injection about the cut. Thirty-six days later enucleation was advised, but refused. Forty-three days later, the vision of the uninjured eye 6/6 with normal near point. Two days later there was a marked ciliary injection. Under atropin the pupil dilated widely, but the following day became small and the injured eye was then enucleated. Ten days later, despite benzoalin and mercurial inunctions, there were vitreous opacities. About three months after his accident, there was increased tension and poor vision in the remaining eye. Paracentesis was performed, posterior synechiae were found which were not broken by atropin; eserin and pilocarpin were used and the tension became normal, with vision 6/20, no congestion of the eye, many deposits on Descemet's membrane. Thirteen months after the injury, the vision was 6/12 with correcting glass. There was iris atrophy with irregular pupillary margin, partly dilated pupil and clouded lens. Asmus urges early enucleation.

Hartshorne reported a case of serous sympathetic uveitis in a girl, nine years of age, who a month before stuck a pair of scissors in her eye. The eye was soft with slight ciliary injection, anterior synechiae and marked photophobia. The other eye showed photophobia, medium sized pupil reacting sluggishly, ciliary congestion and five or six small deposits on Descemet's membrane. The injured eye was removed. No pathologic report. Treatment consisted of hot compresses, atropin, sodium bicarbonat, sodium salicylat, at first 45 then 50 and finally 35 grains a day. The child weighed fifty pounds. The last three weeks she was also given mercury with chalk half a grain three times a day. The remaining eye cleared rapidly, disc became of normal color and vision with correction 20/30.

Butler's case, a boy eight years of of age, was struck in the right eye with a piece of rusty iron. The eye was removed nine days later, and on section showed a purulent hyalitis. Five weeks later there was cyclitis of the other eye with edematous cornea, pericorneal injection, posterior synechiae and keratitis punctata. Blood negative. Under galyl injections and large doses of sodium salicylat, the inflammation rapidly subsided, but the vitreous remained opaque and the corneal precipitates persisted. During the acute attack his temperature was 104° for three days but, as the child had had recurring attacks of fever, the interpretation must be in doubt.

Wright's case was an 18 year old girl, whose eye was injured by a knife which cut thru the upper lid and outer side of the cornea and iris. She had no operation, but thirty days after injury the other eye showed circumcorneal injection. She refused enucleation. The iridocyclitis became marked and pupil contracted with many adhesions. Fourteen days after the first symptom in the second eye, enucleation was performed. Under mercury, sodium salicylat, atropin and hot compresses the eye grew steadily worse. She was then put on benzoalin. The eye whitened, but she had several recurrences, until finally all symptoms disappeared after the removal of her tonsils.

Friedenwald reports the case of a girl, sixteen years old, who had a perforating corneal ulcer of the left eye with prolapse of iris, the result of Neisser infection. When first seen by him, there was a bilateral uveitis with marked reduction of vision. She was treated with atropin and sodium salicylat, but the vision decreased. After having been practically blind for several weeks, she was given old tuberculin. An internist believed that the intracutaneous injection of T. R. showed some definite tuberculous infection somewhere in the body. Friedenwald does not believe the evidence sufficient to warrant citing the case as one of tuberculous uveitis. Following long continued use of tuberculin, the final result was 20/19 in the right eye and 20/152 in the left.

The patient of **Jess** was injured in war and refused enucleation. Four weeks following his accident, sympathetic ophthalmia started as a neuroretinitis and developed into a plastic iridocyclitis. A month after the ophthalmia had started, the eye was removed. He was treated with mercury, benzoalin and electrargol for a year and a half, at the end of which time the vitreous was clear, but there were several small spots of choroiditis and retinitis particularly in the periphery. He had poor light sense with normal color perception only in a temporal crescent, and yellow and blue were lost in every other part of the field.

Rochat reports the case of a boy, seventeen years of age, who, while at work in an anilin factory, had a piece of metal enter his eye. He had no pain, but a few hours later a physician found a small black foreign body in the posterior chamber. A conjunctival incision was made back of the limbus, and three days later he came to the clinic with no redness of the eyeball, but a small conjunctival wound, media clear, vision with glasses 6/12. Two disc diameters above the disc was a white area with a glittering foreign body, and below this a freely movable clot. The other eye vision 6/12 with glasses. He had some pain when the large magnet was applied, so that a scleral incision was made and the body easily removed with the small magnet. Several days later the uninjured eye showed ciliary injection and vision of 6/36. The disc was swollen, congested and near it was a small retinal hemorrhage. Scopolamin showed several small synechiæ, also deposits on the capsule. The injured eye showed no redness or synechiae, but across the disc was a small vitreous opacity (which at times floated over it), which came from the area where the foreign body had rested. Near and below this, were areas with pigmented margins, disseminated choroiditis. Nose examination negative. Blood Wassermann reaction negative.

The injured eye was not enucleated. He was given three doses of 3/10 gram neosalvarsan, aspirin, mercurial inunctions and atropin. At first the eye was worse, vision dropped to 1/60. In the second eye the hemorrhage and precipitates disappeared. The final result was vision of 6/5 in the second eye with a few synechiae and gray floaters in the vitreous. The first eye, with glasses, vision 2/15 with detachment of retina, but no new choroidal areas. He questions the cause and wonders if the Wassermann reaction might not have been positive had the blood been examined before the treatment was started.

A man of twenty-five was seen by **McClelland**, three days after a chip of steel had struck his left eye. He sought aid because of pain. The vision of the right eye was 20/20, vision of the left light perception. There was intense congestion, clouded cornea, small, irregular pupil with hypopyon, and a wound in the sclera at the limbus with iris prolapse below. The giant magnet caused pain. After an X-ray, the foreign body was removed thru the original entrance wound. He was then advised to have the eye removed, but after staying in the hospital four days disappeared for six weeks. On reexamination, it was found that the vision of the right eye was 20/200, pupil contracted with marked ciliary congestion. The injured eye was quiet, but was immediately enucleated. One abscessed molar was extracted, and his chronic intestinal disturbance corrected with diet. After staying in the hospital nine days under atropin and sodium salicylat the vison was 20/100, cornea clear with a few Descemet deposits and cloudy vitreous. Three weeks later he had light perception with more uveitis, pupil fixed, cornea clear. It was considered inadvisable to give sodium salicylat because of his intestinal condition. He was given an injection of sterile milk without reaction, except that the white blood count rose from 8750 to 13750. Altogether he had three injections of milk, with only a slight increase of leucocytes. Six weeks later the patient left the hospital with the eye markedly congested and vision equal to light perception.

Treatment.—**Fage** recommends exenteration instead of enucleation in all cases of panophthalmitis, for he believes the danger of sympathetic ophthalmia is thereby avoided.

Wetzel saw a sailor who said he had always had good vision until a few hours before, when he was struck in the left eye with a piece of rope. There was a 6 mm. corneal wound near the limbus, thru which the iris projected. The prolapse was immediately cut off, and four days later the wound cauterized. Fourteen days after the accident, the cut was again cauterized and a conjunctival suture placed. Thirty-seven days after the accident, his projection field was so poor and uncertain that simulation was considered. Vision was then 6/15.

Nine days after last examination, he claimed that the other eye bothered him, and the vision that had previously been normal was 6/8 and a slight ciliary congestion was evident. The next day there was a fibrinous exudate in the anterior chamber which, however, lasted only twenty-four hours. At this time he complained of headache, had a few synechiae and the outline of the disc was hazy. There were no corneal deposits in the right eye. The headache increased with vomiting and photopsia, so that the injured eye was enucleated. The vision of the right varied from 6/12 to 6/60, but on discharge four months later was 6/8, and the fundus still remained hazy. No pathologic examination. Later it was thought that he was simulating, but finally he complained of poor hearing and the case is reported as an anaphylactic process involving the cochlea.

A rare case of sympathetic ophthalmia, with detachment of the retina which resulted in healing, is reported by **Akiya**. In a boy of 15, there appeared after an injury to the right eye an iridocyclitis. A month later a slight inflammatory condition appeared in the left eye, with interference of hearing. The detachment in the lower part was very apparent. The injured eye was enucleated and examined histologically. There were changes in the choroid characteristic of sympathetic inflammation.

After the operation, the condition of the left eye improved and the detachment of the retina slowly receded; and later the fundus showed a dirty surface with many small pigmentations. In the retina there were yellowish white irregular stripes. Vision, 0.3.

Prevention.—**Tieri, D. A.**, sums up recent civil and military *statistics*, including some of his own, on the occurrence of sympathetic ophthalmia. In the war of 1870, it was stated that 55% of the ocular wounds produced sympathetic ophthalmia. According to Hobby, in civil practice, it occurs in 11.6% of ocular wounds. The great war was marked by the occurrence of very few cases of sympathetic ophthalmia. Weekers saw no cases in a series of 800 ocular wounds, Morax was only able to collect 39 cases occurring in the French Armies during the whole war, and Schevensteen saw only two occurring in the Belgian Army. Tieri saw no cases in a series of 150 ocular wounds.

Many authors, such as Morax, believe that this low figure was due to the early enucleation, which was done in most cases. Others lay stress on the effect of early enucleation. Kalt, for instance, believes that enucleation in the first three or four days should never be done, since he believes sympathetic ophthalmia to be a rare occurrence in war wounds. When any operation is necessary, he believes that evisceration usually suffices. Theories of the pathogenesis are summed up and pathology, anatomy, symptoms, diagnosis and prognosis are discussed.

The recent experience has proved that the prognosis is better than in the old days, many cases running a mild course, so that it can be definitely said that there is no difference between "sympathetic irritation" and sympathetic ophthalmia except one of degree. The question of enucleation versus evisceration is discussed. After sympathetic ophthalmia has developed, if the injured eye has no vision, it should be enucleated at once. If it has vision, it should be treated and enucleated only as a last resort. Tieri has, however, seen sympathetic ophthalmia, which was apparently cured reappear after enucleation, so that treatment must be continued some time after enucleation. He condemns early enucleation at the front as unnecessary, and for the reason that it is nearly always poorly done.

Two indications for evisceration are: 1. Conditions such as those at the front when haste prevents a careful enucleation, since evisceration is much easier for the general surgeon to carry out properly. 2. Panophthalmitis, when the eye is full of pus.

Treatment by serum of patients convalescing from sympathetic ophthalmia has been proposed by Zur Nedden, and tho it has not yet given encouraging results, something may be hoped for from further development of its technic. Salvarsan has given variable results.

Santos Fernandez thinks we should take the greatest pains to avoid sympathetic ophthalmia. Its prognosis is always grave, but enucleation for all kinds of injuries should be avoided. He cites a case of intense inflammation in the eye of a laborer from the goring of a cow's horn, leaving in its wake defective vision and a partial destruction of the retina. The patient was absent for some time and on his return asked for removal of the eye as it had been advised by another physician. His surprise was great when the author held this to be inadvisable and unnecessary. The fear of sympathetic ophthalmia should not be exaggerated, as it is not so frequent as is supposed; but we should watch carefully any case lest sympathetic disease should present itself. An eye retained, if with defective vision, is better than none, should accident come to the good eye.

Glaucoma

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This section reviews the literature of the subject from March, 1921, to March, 1922. For previous references see Ophthalmic Literature, 1921, v. 17, p. 172.

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DIGEST OF THE LITERATURE.

ANATOMY CANAL OF SCHLEMM.—**Uribe-Troncoso** reviews the various investigations regarding the physiologic nature of the canal of Schlemm. The prevalent view in ophthalmology today is to consider the Schlemm canal a venous sinus. This was Leber's opinion, which Schwalbe at first disagreed with, but finally accepted. The author in 1909, as a result of physiologic investigation conducted on the filtration of the fluids of the eye thru the angle, arrived at the conclusion that its contents were entirely of lymphatic origin; the lumen being filled under physiologic conditions by the aqueous, and only entered by blood coming from the anterior ciliary veins when the general blood pressure was increased to such an extent that the normal barriers were overcome.

The author makes use of Maggiore's work on the anatomy of this region to clear up some doubtful anatomic points, and then proceeds to describe his experiments on the eye of a rabbit. The conjunctiva was cut around the sclerocorneal margin, as in enucleation, and dissected back to the equator; the eye passed out of the orbit and thru a piece of rubber dam, then immersed in oil to collect the filtrate, and after an hour the oil was centrifuged.

In opening the discussion on glaucoma operations at the Vienna Congress, **Wessely** presented a resume of the physiologic and anatomic basis for the newer procedures, taking up also the anatomic results produced by iridectomy, iridencleisis, cyclodialysis, Lagrange sclerectomy and Elliot's trephining. But his systematic paper contains only what he or others have previously published.

In his experiments on the nutrition of the eye, **Hamburger** thinks he has demonstrated that the contact of the iris with the anterior capsule of the lens gives a water tight separation of the anterior from the posterior chamber. He supports this view with experiments showing that contact of the walls of the alimentary canal after death prevents the passage of a staining fluid.

CHANGES IN INTRAOCULAR FLUIDS.—In connection with his experimental studies of the alterations in the intraocular fluid of the eye in rabbits, **Wessely** calls attention to the value of Pulfrisch's modification af Abbe's refractometer for estimating the amount of albumin in the aqueous. This amount varies from 0.01 to 0.1 of one per cent. He has also studied the changes found in the ciliary and uveal iris cells after tapping the anterior chamber, as associated with aqueous changes, in rabbits, cats, apes and man.

REPLACED AQUEOUS.—**Hagen** writes on the interchange of intraocular fluids as studied by Wessely. The latter found an increase of albumin contents in the regenerated human aqueous, while Hagan ascertained no change in the second aqueous from the first. This discrepancy is explained by the long intervals between punctures. Hagan obtained the same quantity of aqueous after a few minutes when the regenerated aqueous is vitreous fluid. After fifty minutes he found an admixture of transudate from the blood current; and after one and one-half hours, in two cases, a higher refractometric index. In Wessely's experiments the second puncture was done three hours after the first and therefore contained more albumin.

INTRAOCULAR TENSION.—**Mazzei** concludes that there is a definite relation between the blood vascular system and the intraocular fluids, which is shown especially by the relation between *venous pressure* and intraocular tension. This intimate relation is due to the effect of venous congestion in filling the venae vorticosae with blood and hence raising tension. The practical deduction from this is, that in treating high intraocular tension, all obstacles to the venous circulation must be removed and anything which increases intrathoracic pressure must be avoided. **Henderson** refers to the very slight pressure on the lid required to alter the balance between intraocular and venous pressure and cause narrowing of the veins on the disc.

Post considers that it is definitely established that intraocular tension can be affected by blocking the nerve impulses at the nasal ganglion, and that this is not a specific action of *cocain* but a true blocking. The duration of the reduction of tension with cocain and adrenalin lasts about one hour, and its amount is about 10 mm. *Injections of alcohol* produce a greater drop, about 15 mm., which lasts for ten days and perhaps longer. The applications of cocain must be directly contiguous to the ganglion, and the alcoholic injections must be directly into the ganglion or no result is obtained. The reaction is due to the *sympathetic*.

Knapp examined a series of 65 cases of primary glaucoma, some of which had been operated upon, to observe the action of *adrenalin* upon the pupil and on the intraocular tension. The tension was taken and the width of the pupil measured. One drop of adrenalin was instilled every few minutes for five times. After adrenalin instillation the pupil dilated regularly, or excentrically, in 60 out of 65 cases of glaucoma, varying from 1 to 5 mm. In these 65 cases, after adrenalin instillation, the tension was unaffected in 40, decreased in 20 and increased in 5. He considers the reduction of tension results from the relief of mechanical causes, and that in some glaucomas there is a retention of aqueous in the posterior chamber, which by dilatation of the pupil and stasis is corrected.

Herbert has made a careful study of 13 cases of *primary glaucoma* in which there was a return of hypertension. The mean period which had elapsed since operation in the recurrent group was 8 years, and the earliest recurrence was more than 3 years after operation. The scars in these 13 cases were of the true filtering type in 5 cases, and in 8 cases the scar was considered in some degree fistulous.

Magitot and **Bailliart**, in their work on ocular *vasomotors* and comparison of the blood pressure in the vessels of the iris and the retina, made experiments on the cat. It was found that stimulation of the cervical sympathetic caused a slight contraction of the retinal vessels, while section caused a dilatation. The same was true of the iris, but the effect was more pronounced. Section caused a slight elevation of the ocular tension, while stimulation caused a slight decrease. Arterial tension is almost the same in the iris and retina, being 45 to 100 mm. of Hg. **Imre** believes that the regulation of intraocular pressure cannot depend simply on the blood pressure and the vasomotor nerve. He turns to the endocrin glands as probably concerned. Hyperpituitarism seems to be connected with intraocular tension, being associated with lowered blood pressure in Basedow's disease and pregnancy.

The *circulation in the choroid* and ciliary body and its relation to ophthalmotonus, and the secretion of the aqueous is discussed by **Bonnefon.** The facts quoted seem to prove that the choroid, instead of being erectile or turgescent tissue, is in reality a venous reservoir with a very sluggish circulation. The vortex veins are usually compressed by the intraocular tension, which their internal pressure cannot overcome. The capillary tension of about 60 mm. is almost completely absorbed by the choroidal plexus, for the pressure in the efferent veins is only 8 mm.

The tensor muscle of the choroid fastens the choroid to the vitreous body, and thus removes partially the superficial layers from the action of the intraocular tension when it contracts. The ciliary contractility, whose normal play implies the perfect elasticity of the ocular membranes, is the dynamic agent of the choroidal circulation. When the muscle acts the venae vorticosæ dilate, resulting in an afflux of blood, which empties thru the perforating veins. To this corresponds a delay in the ciliary circulation, due to the profuse anastomosis. The vortex veins thus act as valves, maintaining a constant pressure in the ciliary body and influencing thereby the formation of the aqueous by the latter.

C. Fromaget, during an operation for glaucoma in which he had used an anesthetic, 3 c. c. of a 2 per cent *novocain-adrenalin* solution, noticed that the dull appearance of the cornea vanished within 5 minutes, the iris which had been scarcely visible thru the *opaque cornea* became visible; perfect transparency made it possible to distinguish the circumference of the pupil clearly. The anterior surface of the cornea resumed its usual brilliancy except at a spot where bullae had broken out. These changes were evidently due to a lowering of ocular tension. In a second case, a tension of 65 mm. was reduced to 25 mm. following allocain anesthesia. The observations show the indisputable fact, that novocain-adrenalin is hypotensive as well as anesthetic. To demonstrate that the novocain had nothing to do with this result, a patient whose tension was 55 mm. before operation was given adrenalin alone without an anesthetic. The tension dropped to 20 mm. in five minutes, with the same clearing of the cornea.

Leplat found in repeated successive observations, after the injection subcutaneously of 1/2 milligram of adrenalin, that the intraocular tension remains unchanged in spite of the sharp transient elevation, variable in amount but always noticeable, of the arterial systolic pressure, both general and retinal. The latter vary similarly. The same similarity of diastolic pressure is found in the radial artery and the central artery of the retina. It rises, remains constant or sometimes slightly diminishes. The tension in the central retinal vein appears to remain constant. **Weve** calls attention to the increase in intraocular pressure produced by cold syringing of the aural canals.

TONOMETRY.—**Cohen** describes a mercury tonometer. His instrument proportions a direct reading of the scale in millimeters of mercury to the corneal resistance, which varies with intraocular tension. It is exact and precise. It avoids the vibrations of an indicator, utilizing a column of mercury in a glass tube without the necessity of changing weights. Its principle is like that of the mercury manometer. The graduation of the scale is established according to the radius of the zone of the piston and the area of the caliber of the capillary tube. Cohen has taken 20 mm. as the average normal tension, and indicates this as a fixed point on the scale. The pressure of the mercury, combined with its weight and that of the piston, produces a depression in the cornea, depending not only on the intraocular tension, but also on the resistance of the cornea. The lower end of the piston is convex, so that it can easily depress the cornea without injuring it.

The instrument consists of a metal tube, from whose lower end rises the foot plate. In the upper part of its interior is a reservoir for mercury, which is united at its lower end to a piston that plays over the support. The upper part of the reservoir is connected hermetically with a capillary glass tube, by means of a wire and a steel disk. On the glass tube is a graduate scale from 0 to 90 mm. of mercury. At its upper end is a key that permits the entrance of air at will.

Stein has designed a new apparatus which works on the principle of the balance. By this means he measures the sinking of the cornea under a variable load. The balance is brought into equilibrium with weights, one small one which corresponds to 3 grams on the arm of the balance and a larger one equivalent to 12 grams. With a micrometer screw the apparatus is arranged so that the pressure weight lies immediately over the cornea. If the small weight is now removed there is a pressure of 3 grams on the cornea. The dial hand is brought to the zero point. The large weight is then removed six times in rapid succession and the result read off. The mathematic mean of these readings is used.

Gjessing examined, with Schiötz tonometer and a 5.5 weight, the intraocular tension of 2,186 eyes in 1,095 individuals. Of these, 1,132 eyes were in patients between the ages of 10 and 80, and were normal in every respect; 1,054 eyes were in patients between the ages of 15 and 87, who showed more or less cloudiness of the lens. Up to 50 years of age, the lenses were sufficiently cloudy to be included among the cases which Vogt designates *coronary cataract.* In 655 eyes between 50 and 87 years of age coronary cataract, alone or combined with senile cataract, was found. Among these, 32 showed changes in the fundus or in the vitreous.

Several eyes were examined not only with the tonometer but also with the corneal microscope and Gullstrand's aperture lamp. In 8 cases between twenty-one and forty-five years of age, with normal eyes, several measurements were taken during different parts of the day, and also as to the effects of various drugs with the following result:

Holocain in a 2 per cent solution had no demonstrable effect, altho transitory spotting of the epithelium was not at all rare. *Homatropin* in a 1 per cent solution produced no change of tension in normal eyes. *Cocain,* 2 per cent alone or combined with homatropin, produced in 6 individuals no change of tension, and 2 only a slight transitory fall. But a 5 per cent solution of cocain was invariably followed by a fall in tension shortly after the use of the drug. Pilocarpin 2 per cent and eserin salicylate in 1/2 per cent solution were always followed by a fall in tension, even up to three lines on the tonometer. The tension measured during different parts of the day showed in normal eyes very slight variations.

The action of certain medicinal substances on the intraocular tension and the arterial pressure have been studied experimentally by **Bailliart** and **Bollack.** Amyl nitrit, which causes dilatation of the peripheral vessels, produces a dissociation between the intraocular and vascular pressure. The former rises while the latter descends, the changes being synchronous. Evidently the dilatation of peripheral vessels within the eye raises the intraocular tension, altho the iris and pupil do not seem to be altered. Previous observations with regard to the influence of adrenalin have been rather contradictory. But these observers find, that when injected behind the eyeball it produces a marked fall in the intraocular tension. Pilocarpin and atropin affect secretions in opposite ways. The subcutaneous injection of the former gave no appreciable change of intraocular pressure, while that of the latter caused a distinct lowering of intraocular tension. Intravenous injection of antipyrin and also of caffein gives somewhat the same dissociation of pressures as the administration of amyl nitrit.

Hertel has studied the condition of the aqueous in diseases causing very low intraocular pressures as diabetes, exophthalmic goiter, etc. The lowest intraocular tension he noted in carbon monoxid poisoning. He thinks such studies will help to solve the problems of glaucoma and intraocular pressure. **Römer** has studied experimentally the reduction of ocular tension by medication. He finds this can be effected without miosis.

Brown made a comparison of tension taken on the sclera between the sclerocorneal margin and the insertion of the superior rectus and the corneal tension, using his own tonometer. The study included report on 66 eyes. The results gave about 11 mm. Hg. excess to sclera above corneal tension.

OPHTHALMOMALACIA.—**Reis** has observed in soldiers 26 cases of ophthalmomalacia, some of a very light character, and some most serious. He found thru histologic examination of six cases that went to enucleation, that the striped opacity observed in the cornea just beneath the epithelium was quite different from keratitis. The author points out that the cardinal symptom of ophthalmomalacia is hypotonus, which may be so intense that the eyeball feels like a relaxed bladder. In 25 of the cases, there had been contusion of the eyeball from shrapnel or grenade splinters. In three cases there had been no previous injury. Thus, according to the author, trauma cannot be considered as the cause; but rather, the effect of battle on the nervous system might be. It seemed possible that the fifth nerve might have some part in causing the disturbance of intraocular fluid metabolism, which leads to hypotonus by way of the sympathetic nerve; that is also involved in the symptom complex miosis, ptosis, enophthalmus. In three cases there was a marked sympathetic ptosis. The author believes that there must be endogenous factors of a psychic nervous order that have some effect on the secretory nerves of the interior of the eye.

Urbanek reports a clinical observation regarding the reduction of intraocular tension made on an anomalous iris by the use of eserin. He regards the iris as a mechanical regulator of pressure between the posterior and anterior chambers.

Riedel reports a case of spontaneous hypotonus in juvenile glaucoma, in a girl aged 13 years, with poor vision for the past five years. With correction R. — 8.00, 20/200; Left with — 8.00, 20/100. The tension R. 70 mm. L. 60 mm. Schiötz. The pupils were irregular and reacted sluggishly. The cornea were somewhat over 12 mm. The brown irides were dull and the design was not well designed. The family history revealed that she had a near sighted brother. The patient was given pilocarpin to drop in eyes. The fields were contracted concentrically to 10 degrees in both eyes. The right eye was trephined, the iris prolapsed, and vitreous presented, followed by detachment of the retina. The eye gradually became smaller with ciliary injection and subnormal tension.

The left eye resisted treatment, its tension remained around 50 mm. Hg. From the beginning of 1918, while the operated eye was slowly shrinking, the left eye began to improve, from 20/70 to 20/50.

Evans reported a case of hypotony, papilledema and suppression of aqueous in a man aged 34 years. He was struck in the left eye by a piece of wood off a spindle ten weeks before. There was abrasion of the cornea and hyphema. He was discharged in 14 days with vision of 6/18. The fundus was hazy. There is slight congestion of the ocular conjunctiva. The anterior chamber is obliterated. The pupil sluggish and larger than the right, media clear and disc slightly hazy and edematous; vessels tortuous and veins somewhat distended. Fine depigmented changes in the macula. Vision 6/18, with correction 6/12 partly. Tension 8 mm. Right eye externally normal, pupil sluggish, media clear. The disc somewhat hyperemic, vessels tortuous. Two small choroidal depigmented patches in the temporal side, near the disc. Fine punctate spots at the macula. With correction 6/6. Tension 11 mm.

HYDROPHTHALMOS.—**Laws** reported a case of acute buphthalmos, in a child on whom Herbert's small flap operation had been performed while the child was still under one year old. Altho the pupil had remained round and central, the subsequent appearance of a small bleb of iris showed that a basal inclusion had occurred in the right eye. For 9 years after the operation, the tension had remained normal in both eyes. Then rise of tension with cupping of the disc began to be apparent in the left eye, and the operation was repeated. The eye with included iris remained good.

Mulholland reported cases of hydrophthalmos in young persons. In the discussion of treatment of this condition, Werner would trephine in selected cases, and would enucleate only in cases of loss of vision, corneal degeneration or pain. Bilateral buphthalmos affecting the eyes of a rabbit is reported by **Rochon-Duvigneaud.** During life a fluorescein solution was injected into the vein of the ear, and its prolonged appearance in the anterior chamber noted. On examination the eyes were found enlarged in all directions. The angle of the anterior chamber was found expanded as compared with that of a normal rabbit, and there was an absence of the cilioscleral reticulum. The anterior chamber was deep, the iris stretched and less than half the normal thickness. The ciliary body almost completely atrophied.

Within the last twenty years Groenholm examined the eyes of many members of a large family, in which *megalocornea* frequently occurred as a congenital malformation, viz.: in three generations in 13 persons, (11 men and 2 women); 5 out of 6 were transmitters. **Groenholm** concludes that hydrophthalmos is a local affection due to a congenital defect of the canal of Schlemm, but megalocornea a bilateral embryonal superproduction of corneal tissue. Probably it originates from a faulty formation of the germ plasm in a similar fashion to hemophilia, family atrophy of the peroneus, optic atrophy and congenital color blindness.

Chance presented a child, aged 5 years, who had been brought to the hospital two years ago with the history of having an enlarged right eye since birth. At that time examination showed the right eye to be markedly enlarged, the external angle and temporal zygoma had an aperture-like incompleteness, upper lid margins thickened and drooping, entropion of the upper lid, cornea almost twice the size of that in the fellow eye and presenting a number of blebs. Media otherwise clear and a view of the fundus obtainable. The left eye was normal so far as could be determined.

At the time the patient was presented, the right eye showed marked enlargement, wide palpebral fissure, lids swollen, with entropion and trichiasis of the lower lid. There was a thinning of the sclera above. The anterior chamber was of normal depth, pupil irregular, not reacting to light. The child counted fingers at 2 feet. The media were clear. There was a deep pathologic cupping of the disc, which was quite pale. Blood vessels were normal in caliber. No discreet lesions of the fundus seen, except the glaucomatous cupping. The left eye was normal.

Weekers presented the case of a patient 48 years old, who had *aniridia* in both eyes with congenital cataract and glaucoma. One of his children, 8 years old, suffered from bilateral buphthalmos with aniridia and cataract, with luxation of the crystalline lens above in one eye. Great importance is attached to the light that such cases throw upon the origin of the intraocular fluids and the pathogenesis of glaucoma. The coexistence of aniridia and glaucoma seems to destroy the theory attributing glaucoma to an obstruction in the elimination of the aqueous humor at the iridocorneal angle. Anatomic examination has shown that aniridia is never complete. It is therefore not impossible that the iris elements present in aniridia suffice to produce the aqueous humor. It is also possible that they obstruct the angle. In this patient pilocarpin reduced the tension to normal in both eyes, acting upon the ocular tension thru the vessels. By constricting the vessels it diminishes the production of aqueous.

Etiology of Glaucoma.—**Maynard** gives an account of 104 cases of epidemic dropsy, complicated with glaucoma. In a household attacked by epidemic dropsy one or more patients may be found complaining of fogginess of vision and of colored haloes. The type of glaucoma is unusual, in as much as the anterior chamber is often normal rather than shallow; it may be deep.

The pupil is rarely dilated, ciliary injection is unusual and pain uncommon. But the tension is raised generally, the cornea may be steamy, cupping of the disc and limitation of the fields, beginning with the nasal, are found early, and are rapidly progressive. Of the 104 cases, 80 were males and 24 females, their average ages about 34 years. The interval between the beginning of the dropsy and the onset of the eye disturbances was between 4 and 5 months. There was often remarkable variation in the symptoms during the day. Even when the symptoms were slight, there was sometimes almost complete loss of vision in one eye and the field was much reduced in the other, central vision remaining good.

Koyanagi reports a case of glaucoma following a wasp sting; a rare occurrence, the more usual sequel being keratitis, with or without hypopyon. Huwald has shown that cataract follows the injury if the poison directly affects the epithelium of the lens, in which case the cloudiness remains localized in the pupillary area. Experimental studies with bees and wasps, carried out bv the author on rabbits' eyes, lead him to the conclusion that there is (1) Severe damage to the sphincter muscle, due, no doubt, to the direct poisoning, leading naturally to mydriasis. (2) Abnormal proliferation of Descemet's membrane, especially in the angle of the chamber. (3) Depigmentation of the iris evidenced by a degenerative change of the chromatophores. (4) The opacity is due to the fact that the poison introduced into the cornea is soluble in the aqueous humor, permanently affecting the lens by diffusion.

By means of colloidal substances, **Seidel** was able to block the filter pores of the eye in a series of animal experiments, resulting in glaucoma. This glaucoma he could eliminate at once and permanently, by emptying the anterior chamber by paracentesis, thereby unclogging the filter system thru the reverse flow following the decrease in intraocular tension. Peripheral iridectomy may have the same result. Clinically this type of genesis was observed in cases where, after discission of the lens, glaucomatous increase in pressure continued to advance, a type that can be treated with success by paracentesis. Extrabulbar factors, such as sudden rise in blood pressure, may start up in an acute attack of glaucoma; and thru the osmotic tension of the blood, intraocular pressure may be favored or retarded.

Koller thinks that the action of mydriatics in dilating the pupil is due to their effect on the vascular system of the iris, rather than exclusively on the muscles of the iris. Atropin and cocain constrict the vessels in the iris and thus dilate the pupil; while on the other hand miotics cause dilatation of the vessels and thus produce a narrowing of the pupil. These statements are borne out by a number of physiologic experiments. The mode of action of *mydriatics* and *miotics* in hypertension is based upon the physiologic effects.

Watanabe reports glaucoma following *luxation of the lens* into the anterior chamber. In one case the patient had retinitis pigmentosa and bilateral hereditary luxation of the lens upward. In the right eye a spontaneous luxation occurred, resulting in glaucoma. The author considers that the entrance of vitreous into the anterior chamber can be the cause of these attacks of glaucoma, as it partly closes the pupil and partly the angle of the anterior chamber.

Cords thinks that simple *papillitis* or choked disc is of no etiologic significance in the production of glaucoma. Coexistence of the two conditions is merely a coincident. The same holds true when papillitis or choked disc develops in a glaucomatous eye. The only cases of papillitis that are secondary to glaucoma are seen in individuals with vascular disease. Among these are included albuminuric neuroretinitis and papillitis in cases of juvenile phlebitis of the central vein. Albuminuric retinitis may give rise to absolute bilateral glaucoma. In such cases, there are constantly found vascular changes and evidences of congestion of the disc in the region of the central veins. Juvenile phlebitis of the central vein may give rise to three different clinical pictures: 1. Papillitis; 2. total or partial thrombosis of the central vein; 3. genuine optic atrophy. Cases belonging to the first and second groups may be followed by glaucoma. In the first group the clinical picture is so characteristic, that one may be fully justified in speaking of them as cases of postpapillitic glaucoma. In most of these cases, high grade visual defects pointing to disturbance in circulation appear very early.

Paltraca propounds a theory which explains glaucoma as due to the loss of equilibrium between the glands of internal secretion, which occurs in old age. The secretions of both the ovaries and testicles, which in young persons exert a hypotensive function become much less, and the hypertensive product of the adrenals predominates. This causes in its turn increase in intraocular tension. As evidence of these views the author describes the effect of endoovarian and endospermin on tension. In persons 25 to 40 years of age, they produce a notable decrease in tension. In cases in which one eye is glaucomatous, they produce decrease of tension only in the normal eye, due to the fact that the anatomic changes have already occurred in the other eye, as the result of high tension, which makes proper drainage impossible. In cases operated on by iridectomy, the extracts kept the tension normal for a considerable length of time. Details of experiments are not given. Reviewing the evidence regarding the regulation of the intraocular pressure by the endocrin glands, **Imre** concludes that it cannot be regulated by blood pressure and vasomotor nerves; but is powerfully influenced by hyperfunction of the hypophysis, as in pregnancy, or the disturbances caused by exophthalmic goiter.

Kiribuchi believes glaucoma is due to a disturbance of compensation of the intraocular stream changes; which occur more or less acutely in the inflammatory form, but gradually in glaucoma simplex. The relations of high myopia to glaucoma are discussed by **Axenfeld**. The typical glaucomatous excavation of simple glaucoma is absent. The increase of pressure is slight or unnoticed. Better studies of the fields of vision in high myopia would aid the early diagnosis of simple glaucoma.

Büttner reports a case of neuralgia of all three branches of the trigeminus, which preceded the onset of glaucoma by several years. The neuralgic pains came on regularly at definite periods of the year, month and day. They were always accompanied by pains in the eyes. Antineuralgics and electric treatment had no effect. Several years elapsed before there were evidences of glaucoma. When they did occur, however, they were not only typical of glaucoma, but were also accompanied by neuralgia of all three branches of the trigeminus. Iridectomy not only relieved the glaucoma, but the moment the operation was concluded the neuralgia had disappeared, and had not returned up to the next winter. **Santos Fernandez** has discussed the relation of glaucoma to the general bodily condition and other factors influencing it, and **Santiago Alonzo** has written a general paper on the subject.

Wernicke affirms that glaucoma is nothing other than one of the commonest forms of intraocular multiple sclerosis. He gives the following reasons: Preglaucomatous lesions are situated in the coat of the iris, which correspond to those of multiple sclerosis. It has been demonstrated that the process of evolution of glaucoma cannot be separated anatomically from that of multiple sclerosis. No remedy is known for either. The wide variations in the clinical picture force us to seek as its cause a disease of multiple foci.

The rate of the settling of the blood corpuscles in diluted blood has been studied by **Ascher**, with especial reference to the rate in patients suffering from glaucoma. He finds that altho in persons at different ages the rate may vary somewhat, it is fairly constant for those of good health, but that in glaucoma and in people with high blood pressure, the corpuscles settle more slowly. This difference can be brought out and emphasized by carefully adjusting the salt and albumin content of the diluted fluid.

SYMPTOMS.—Under normal and pathologic conditions, **Koeppe** distinguishes which is of especial differential diagnostic importance in the following formations of subjective *colored rings* in the living ocular media, by the application of the grating theory: (a) The precorneal or lacrimal (Meyer's) colored rings of from 1.25° to 2.50° angle radius in red. This phenomenon is found in conjunctivitis, or slight irritation of the conjunctival sac, and in the presence of finely distributed ointment on the cornea. (b) The rings due to diffraction of the corneal corpuscles; which physiologically, and in glaucomatous corneal stasis without inflammation, have in red an angle radius of from 1.50° to 1.75° and seem to coincide with Meyer's rings. (c) The lenticular color rings frequently observed in normal eyes with medium sized and dilated pupils, of from 3.5° to 4° radius in red, owing to radial grating of the living lens fibers. (d) The rings of from 5.5° to 8° in red, in the preglaucomatous and glaucomatous attacks of increased tension without any inflammatory signs. These vitreous rings seem to be due to simple space grating of the vitreous structure, which optically becomes more opaque by the increased tension, because the measuring of the diffraction constants of the grating of the vitreous approximately corresponds to the distance relations of the filtrations of the vitreous.

Koeppe urges, therefore, in patients who complain of seeing colored rings the measuring on Igersheimer's disc the angle radius of the rings, for the differential diagnosis of true from spurious glaucomatous rings.

Thompson showed the case of a woman aged 52 in whom there were discs with large intermarginal cups, without any symptoms of glaucoma. The tension was normal. Sometimes the eyes were misty. Haloes had not been observed, and no opacity of the lens could be made out. He considered the case was on the way to development of glaucoma.

Elliot's paper on the yielding of the optic nerve head in glaucoma is a study of the anatomy of the scleral canal and the relationship of the canal to the nerve head and lamina cribrosa. The cuts illustrate clearly the main types of lamina; their location in the canal whether in the anterior or posterior part or occupying the entire canal; how this location of the lamina effects the cupping of the disc, and the various types of cupping. He discusses the origin of the supporting framework of the nerve fibers in the nerve head and the effects of intraocular pressure upon the same.

The stereomicroscopic picture of the angle of the anterior chamber of the living eye as seen in glaucoma has been described and illustrated by **Koeppe,** who draws attention to the differences exhibited between the preglaucomatous conditions and that exhibited after the root of the iris has become fully adherent to the periphery of the cornea.

Batten, in writing on the premonitory symptoms of glaucoma, mentions three; a shallow superficial tension, i. e., an increased deep tension; a shallow anterior chamber, and the cupping excavation of the optic disc. He also referred to his India rubber balloon experiments.

In some practical considerations of the congestive type of glaucoma, **McGuire** gives emphasis to the importance of the early diagnosis of glaucoma, and states clearly the well established guides in its recognition.

Burnham discusses various forms of primary glaucoma with special reference to prognosis and treatment. In the first group, he places those cases of acute glaucoma that respond quickly and permanently to an iridectomy. When acute cases do not so respond, and there occur pain, congestion and plus tension, it means that there has been in addition too much congestion and swelling of the ciliary processes, an actual inflammation of the ciliary processes. If this second variety in addition to iridectomy be treated with mercury and iodid of soda and perhaps atropin, a good and permanent recovery will result. The author considers this disease primarily due to a pathologic condition of the ciliary processes, and certain variations of this condition are accountable for the varieties of glaucoma.

Blatt states that hemeralopic affections have often been observed during the progress of glaucomatous diseases, and that a certain connection can be established between the degree of hemeralopia and the malignancy of the glaucoma.

Hess gives a review of the anatomic points involved in and the symptoms of primary glaucoma, with a differential diagnosis. **Hoeg** discusses the cloudiness of the cornea associated with disturbance of ocular tension. **Morax** reviews glaucoma and the glaucomatous, in a work of 368 pages, well illustrated. **Illig** bases a paper on primary glaucoma upon 406 cases seen at the Munich clinic in six years.

Würdemann reported a case of acute glaucoma following traumatic iritis and detachment of the retina. The patient was a male 41 years of age. He had been blind in the left eye for two years following an injury to the head. The eye was tender and inflamed from time to time with shooting pains. When seen by Würdemann, vision of R. was 6/6, L. blind. He had many capped teeth, some abscessed. These teeth were removed. Iritis of the left eye with total detachment of the retina. Tension minus. He was placed under medical treatment. One month later the eye was quiet. Later tension was plus 3, with other symptoms of acute glaucoma. A trephine operation with iridectomy was done three months later. Slight loss of vitreous. Operation completely relieved the symptoms. Transillumination absolutely negative.

Glaucoma Cup.—The cases reviewed in **Pickard's** paper were a conservative series, eliminating only actual cases of glaucoma and other diseases affecting the disc. The cases were grouped in ten year periods. The author showed by means of the epidiascope the various shapes of physiologic and glaucomatous cups he found. In the former there was certainly pressure from within. The glaucoma cup was usually a simple and symmetric enlargement of the physiologic cup. In a small number the conical enlargement was added to the cylindric form. If most of the glaucomatous cups were enlargements of the physiologic cups caused by internal pressure, then presumably smaller degrees of pressure acting on cups in which the tissues were weak would cause lesser degrees of enlargement, without necessarily producing any deterioration in vision. The author thinks there is a tendency for the physiologic cup to enlarge with age.

In discussion, Thompson did not think Pickard has sufficiently emphasized the distinction between the ordinary shallow cup usually presented and the perpendicular cup; the latter often overlapping so that the vessels come to the edge of the cup and disappear from view, until again seen in the lamina cribrosa. Batten thought that so long as the cupping was restricted to the center it might be looked upon as Nature's trephine hole. Cups would increase under normal tension. Mayou thought cupping was dependent not only on the intraocular tension, but also upon the condition of the nerve fibers as they passed thru the lamina cribrosa.

Thompson inquires what do we mean by physiologic cup? Following a description of the common form as found in most text books, he describes another well marked variety. The cup occupies from a quarter to one-half of the diameter of the disc. The uncupped margin is only slightly wider on the nasal side than on the temporal side. The margin of the cup is defined all around by a definite line. Instead of being shelving it is abrupt, positively overhanging the lamina cribrosa, so that the vessels instead of gradually sloping down the sides of the cup curl around the margin, behind which they are invisible until they reappear on the floor; just as in the typical glaucoma cup, except that the abrupt margin is situated considerably inside the disc margin. Sometimes one finds an overlapping cup such as this, much larger, occupying three-fourths the diameter of the disc or more.

The author seeks an explanation of these cups and quotes the work of Schöen. In his experience the small variety of overhanging cups may be found in young people. The large overhanging cups are found in his experience in patients over fifty years of age. Altho some people with these large overhanging cups have perfectly normal vision, there are others in whom one finds suspicious symptoms of glaucoma; which may come to nothing or which, after giving no trouble, may suddenly flare up into glaucoma. The author then quotes a number of cases illuminating this point.

Bleiker reports the case of a woman, aged 56, affected with intense arteriosclerosis and glaucoma simplex with deep excavation, in whom an apoplexy led to increased intracranial pressure and choked disc. After subsidence of this, the atrophic glaucomatous excavation reappeared, showing that it was only an accidental, temporary coincidence of glaucoma and choked disc.

All patients attacked by a primary glaucoma have been submitted by

Charlin to a thoro clinical examination, with special regard to the serologic and cardiovascular point of view. His report is based upon 75 cases. One fact dominating this study of the clinical material is the extreme frequency of general vascular alterations, 90 per cent, which permits the conclusion that these general vascular alterations are the rule in glaucoma. It is shown that eyes having suffered primary glaucoma always exhibit lesions of the vessels. Glaucomatous hypertension is due to a failure of the automatic power of regulation of ocular tonus. In spite of this vascular origin of glaucoma, it is absolutely independent of arterial hypertension.

Simple Glaucoma.—**Wilder** has observed that the condition of glaucoma is frequently overlooked and even when recognized or suspected, is frequently neglected or imperfectly treated. In a clear and concise paper, he takes up the problems in etiology, diagnosis, tonometry and treatment.

Bulson thinks the ease by which simple glaucoma may be overlooked, and the difficulties in early diagnosis call for emphasis on the cardinal symptoms of this most complex disease.

Köllner reported the case of a man, 71 years of age, showing in the right eye typical glaucoma simplex with deep excavation. Vision 20/200, central scotoma, and normal fields. The left papilla was normal but visual acuity was reduced to 4/200 by strabismus amblyopia.

Daily tonometer readings varied between 40 and 60 mm. for the right eye; between 30 and 40 mm. for the left; so that a beginning glaucoma in the left eye was regarded as undoubted, in spite of the normal appearing fields. Pilocarpin reduced the tension only transiently. The patient reappeared after two years and the eye grounds remained unchanged. Vision in the right eye had fallen to distinguishing fingers. The left was unchanged. The author found the tonometric readings on each side only 22 mm. During a week's observation, the readings varied between 24 and 30 right, and 19 and 25 left. Optic atrophy had progressed in the right eye, but the left eye gave no hint of previous trouble. Köllner raises the question whether in older patients, with improvement in drainage, the tonometer values may not fall to normal.

Dodd reported a case of simple glaucoma in a woman, aged 59 years, in whom vision had been failing two or three years. When seen, vision in the right was fingers at 2 feet, and 6/7.5 with correction in the left. The discs were deeply cupped, the right more than the left, and were pale. The right field was nearly normal in outline for white but had a large crescentic scotoma below involving fixation. The left field was normal but with an abnormally large blind spot. Tension was R. 60 mm., L. 40 mm. After the use of miotics, tension five days later was 40 mm. R., 30 mm. L.

A Lagrange operation was performed on both eyes under general anesthesia. Massage was used daily. At the end of a month the tension was normal in both eyes. Five months afterwards the tension was 18 mm. right and 24 mm. left. The tension continued the same until 9 months after operation, when it was 24 mm. in the right and 40 mm. in the left. A trephine was done below with iridectomy, and 2 months later tension was 22 mm., and three months after operation tension was 10 mm. Seven months after the second operation, vision began to fail again and examination showed small lens opacity, which increased until the opacity was complete, when the lens was extracted. Vision was 6/10 with correction. A year later she returned with pain in the eye, tension was 28 mm. rising to 40 mm. A trephine operation was performed at the site of the former trephine operation. This brought tension to normal and vision again to 6/10 with correction. This state of affairs continued for about three years, when she returned with vision of 6/60, tension 27 to 33 mm. A large conjunctival flap was dissected up from below, and directly over the trephine opening a dense glistening membrane was found grown fast to the sclera, preventing drainage. This was removed and good drainage reestablished.

CASES OF GLAUCOMA.—**Würdemann** reported two cases of chronic glaucoma. One in a merchant, aged 63, whose right eye for the last three years has become inflamed, and vision failed with each attack. Sees haloes. Blood pressure 210—125. Vision, right fingers at 4 meters, left 6/60. With + 2.50 added to R. and L., vision equals 6/24 and 6/6. Fields, right constricted to a small circle, under 10 degrees on the nasal side and under 20 degrees in other directions. Left visual field slightly constricted. Tension R. plus 3, L. plus. Glaucoma discs in both eyes. Angiosclerotic vessels. Acute glaucoma resulting, he was sent immediately to the hospital and two pounds of blood were removed by venesection. Eserin, hot compresses and purgatives were employed. Later a double trephining was performed with iridectomy, with ether anesthesia. The flap was held in position by stitches. Vision R. 6/60; L. 6/12 with correction, one month after operation. Three months after operation; R. 6/12; L. 6/10 plus. Fields, right increased to about 40 degrees, left to normal. This case shows unusual restoration of vision in an almost blind right eye.

His second case was in a man, aged 64, whose right eye had been sore for a week. Haloes. Vision R. counts fingers at 50 cm.; left 6/12. Fields R. contracted to 20°, L. between 40° and 30°. Both discs cupped. Eight days following the first visit, a double trephine operation was performed with iridectomy under local anesthesia, preceded by hyoscin grain 1/100, morphin gr. 1/4. The recovery was uneventful. Vision with correction R. 6/8—2; L. 6/3 1/2. The fields increased to full size.

Matson presented a man, aged 62 years, who was hit on the right eye in 1882. Cataract was noticed in 1892 and dislocation of the lens. In 1910 the vision had improved, but in 1921 he developed glaucoma. Posterior sclerectomy was done. Aided by eserin and hot applications, the tension was reduced below normal.

Boyd reports a case of simple chronic glaucoma in which the tension was reduced by cyclodialysis from 50 to 20 mm. within ten days, and has remained there.

SECONDARY GLAUCOMA.—**Hudson** reported a dislocated lens with acute glaucoma in a male aged 54. He had received a blow from the fist in the left eye in January, 1919. Vision was noticed to be defective in September of the same year, with occasional attacks of inflammation. He was admitted to the hospital in December, 1919, suffering with acute glaucoma and bulbar keratitis in the left eye. The lens was dislocated downwards and backwards. Tension plus 2. Trephined with iridectomy in January, 1920. Tension normal since. Two cases are reported by **Abadie**, one in a woman who had suffered from rheumatism and uveitis and the other, who after acute disease had noticed impaired vision.

Greeves case was one of total *detachment of the retina* of the left eye with glaucoma, in a girl 14 years of age. She had never had good vision in the left eye. Attended in the hospital six years ago, but no note of detachment at that time. Given glasses two years ago; plus 7 spherical with plus 1 cylinder. No note of any abnormal condition at that time in the left eye. No history of pain or redness, but she had received a blow on the left temple when seven years old. There are at present dilated circumcorneal veins. The cornea is bright, no keratitis punctata. Anterior chamber of normal depth. Pupil slightly dilated, active. Total detachment of the retina. Degenerative cyst of the retina down and in. Deeply cupped disc with atrophy. Arteries are small, veins rather full. Vision, light perception. Plus tension, lowered under eserin.

In discussion, Story assumed the glaucoma was secondary, the primary condition being detachment of the retina. Mayou had a similar case in a child. The enucleated eye proved to be a case of massive retinitis.

Zorab recalled two cases, one in a child the other in a young adult. The eye of the younger patient was enucleated and found by Stephenson to be massive exudation.

Out of 7,076 senile cataract extractions, **Herrman** reports 17 eyes developed glaucoma. The anatomic cause could be demonstrated in most cases, and in the others it was probably due to trauma of the ciliary body causing secretion of high molecular albuminous bodies which obstructed the chamber angle.

After extraction of senile cataract, **Meller** thinks one occasionally encounters intraocular pressure due to various causes, as cyclitis, iridocyclitis with exudation into the anterior chamber. Circular synechiae of the pupil with the capsule of the lens, synechiae of the iris into the incision, and synechiae of the iris with the cornea. Aside from this secondary glaucoma, primary glaucoma occurs without any apparent cause, either in the acute form, or which is more frequent, in the chronic form. But this glaucoma is secondary, as probably the anterior chamber is not reestablished early, possibly thru remnants of lenticular matter in the wound retarding the agglutination of the edges of the wound, which can also have the effect of attaching the iris into the angle of the chamber.

Stieren reported three cases of glaucoma occurring after *cataract extraction* with iridectomy. His first case in a man, aged 32 years, in whose left lens a foreign body lodged. Extraction with iridectomy resulted in vision of 6/6. More than ten years afterwards, he returned with a bullous keratitis, tension 70 (McLean) and vision reduced to counting fingers at 1 foot. This condition had existed for three weeks. Miotics failing, the eye was trephined at the lower limbus. A considerable amount of viscid fluid escaped. Healing of the conjunctival flap was satisfactory, and the keratitis disappeared. He was discharged three weeks afterwards with corrected vision 6/20, tension 20. After reviewing the literature, Stieren leans toward the view that the vitreous closes the spaces of Fontana, and is the chief causative factor in closing the filtration angle.

Igarashi reports the case of a boy, aged 15, with symptoms of hemorrhagic glaucoma in the right eye. After enucleation it was found that a detachment of the retina and a hemorrhage were present, and near the papilla were a few round, rather large connective tissue tumors. They were placed close to the atrophic choroid and seemed to have originated from the same tissue or from the pigmented epithelial layer. Such new formations, large and small, were also visible at many places.

TREATMENT OF GLAUCOMA.—**Rossi** gives some account of results obtained in lowering ocular pressure by the use of extract of lymphatic glands. He was led to use it on account of its action in lowering general blood pressure when injected intravenously. The extract was instilled as drops in 2 cases of chronic glaucoma, and in one of absolute glaucoma. In one of the chronic cases, the tonometer showed a very considerable reduction of blood pressure, in the other two a moderate amount. In none of the cases was there any effect on the vision, or size of the pupil.

Watson recommends free catharsis. The fluid extract of jaborandi may be given in 1/4 to 1 dram doses t.i.d.

Guibert reports three cases of traumatic glaucoma treated with iodat of soda. The first patient was injured in the left eye with a cork. Severe pain followed, the cornea became cloudy and edematous, the anterior chamber filled with blood. There was no injury to or dislocation of the lens. The tension was greatly increased. Diagnosed as traumatic hemorrhagic glaucoma, with vision of 1/20. Pilocarpin was employed without result, altho used five times in 24 hours. Quinin and bromid of potassium were also used. The pain remained intense and vision was not improved. Then a subconjunctival injection of 1 c.c. of a ten per cent solution of iodat of soda was employed, with immediate relief, and after several days vision increased to 2/3.

The second case followed a fall from a bicycle. Subconjunctival injections of iodat of soda were followed by immediate improvement with return to normal. In the third case the glaucoma was manifest, and the anterior chamber was so reduced that iridectomy could not be employed. Pilocarpin and iodat of soda was employed, and the next day the anterior chamber was so increased that iridectomy could be done easily.

GLAUCOMA OPERATIONS. — **Gifford** writes on his experience with *peripheral iridotomy,* as practiced by Curran, in the treatment of glaucoma. The paper is based on the author's experience in 30 eyes operated in 23 patients. Twenty-two eyes were of the kind Curran thinks best suited to his procedure. They were quiet, distinctly glaucomatous eyes, with tension ranging from 32 to 70 (Schiötz), in which the iris could be distinctly seen to be pushed forward to some extent by the lens. In 17 of these an apparent cure was effected. The tension dropped to below 23 and remained there with vision and fields as good or better than before the operation. In 4 the result was only moderate, the tension going down from 37, 47, 32 and 40 respectively to 27 in all four. In one the result was distinctly poor. In 8 eyes in which the iris was not pushed forward at all, the results of the puncture were practically negative. The author discusses the technic, fixation and anesthesia, and concludes:

1. The results of peripheral iridotomy prove conclusively that in a large proportion of cases of chronic glaucoma and probably of the acute form also, abnormal iris-lens contact plays an important part.
2. Nearly all, if not all, cases of chronic glaucoma with shallowing of the anterior chamber can be relieved for many months, and probably indefinitely, by making one or two holes 1 mm. in diameter close to the root of the iris.
3. The experiences of Curran indicates that acute glaucoma or exacerbations of the chronic form can also be cured by the same operation.
4. Where the chamber is deep the effects of peripheral iridotomy are apt to be negative or not permanent.
5. Even if the results of the puncture prove not permanent, it is so simple that it can be repeated with very little strain or danger.
6. If the favorable results of the operation prove to be permanent, peripheral iridotomy, or some modification of the same principle, is destined to replace ordinary iridectomy and the filtering operations from a large part of the field which they now occupy.
7. The peripheral iridotomy as proposed by Curran while very simple and satisfactory in many cases, is by no means easy nor even possible nor safe to perform in all cases. The substitution of some less simple but more reliable method of making a hole thru the iris periphery may eventually turn out to be more practical.

Removal of a part of the vitreous has been proposed by **Zur Nedden** among other things for glaucoma. He reports two cases of traumatic glaucoma following the subluxation of the lens, and one of hemorrhagic glaucoma, in which small amount of vitreous was removed with apparently good results.

Holth writes on a new technic for *iridencleisis,* and punch operations. The article is illustrated by seven cuts and a bibliography.

Iridencleisis simplex is employed in cases where iridectomy has previously been performed, and iridencleisis with meridional iridotomy in cases not operated before. In the sclerectomy operation, the technic is improved by a conjunctival flap similar to Elliot's trephine and reducing the size of the punch blade to 1 mm. width. The blade is inserted in a tangential direction from the incision and the handle lowered until it forms an angle of about 150° with the plane of the iris.

Herbert says there has always been something elusive in *small flap sclerectomy,* and insufficient explanation of the variable results obtained even by the individual surgeon. Apparently the reasonable explanation has been found in the method of Cruise, of after treatment by the application of finger pressure to the eye from the beginning, to force up the little trap door and prevent immediate healing. At Nottingham it has been the practice to get the patient out of bed on the day following operation, and to discharge him from the hospital within a week. The application of gentle sustained finger pressure thru the lower lid may be started on the afternoon or evening of operation day, and repeated two or three times daily, partly emptying the anterior chamber. After the first few hours the patient should be encouraged to keep his eyes open and blink frequently. A pad may be required for the first night or two, and a shield worn only during the day.

Kiribuchi describes his method of operation in glaucoma as follows: A flap of conjunctiva above the cornea is cut and turned downward. He then makes a broad incision with a lance in the sclera and a large *iridectomy,* whereby the iris is pressed in on both edges of the wound, and the conjunctival flap is replaced and sewed with a loop suture. Afterwards the eye is often pressed upon, so that the wound is burst open repeatedly. In this manner a subconjunctival fistula is established. In the past five years the author has had good results in many cases. **Hong Tjoen Yap** has written on iridectomy in glaucoma. The efficiency of prophylactic iridectomy is vouched for by **Menacho. Marquez** has written on the technic of simple iridectomy. **Uhthoff** has compared the results of the newer operations for glaucoma with classic iridectomy.

Zorab gives late results of *aqueoplasty* or drainage from the anterior chamber to the subconjunctival space by means of silk left in situ. His remarks were confined to recounting the leading cases in which the process failed to do what he wished. These are grouped under four headings:

1. Suitable cases where the operation was well executed, but the result not satisfactory. This group includes the cases where the silk retracted from the chamber.
2. Where the case was unsuitable, the operation well executed and the result unsatisfactory. This group contained a large number of the failures, and comprised principally absolute glaucoma.
3. Where the case was suitable, the operation badly executed and results unsatisfactory. The trouble is confined to two points, tearing the conjunctival flap or faulty suturing.
4. Failures from miscellaneous causes, including those cases which are met with in all fields of surgery.

In discussion Mayou said his reasons for giving up aqueoplasty were that the silk retracted and the use of the silk introduced a foreign body in the eye.

Wood, in the operative treatment of glaucoma, briefly describes the *Lagrange* operation and the case in which it gives the best results. He describes the trephine operation and iridotasis as performed by Borthen. He has had entire success in the latter procedure when he instilled atropin twice, once seven and again four hours before operating, and made the linear incision as small as could be worked thru. **Lagrange** urges that sclerectomy with total peripheral iridectomy is still the operation of choice for chronic glaucoma. Failures of this operation occur in acute cases or in absolute glaucoma with very high tension.

Ellett reported two cases of glaucoma. In one case the tension was R. 50-60, vision, R. 1/200; L. 0. A Lagrange operation was performed on the right eye and vision was improved to 4/200, tension 37 (Gradle).

In the second case vision had been failing fourteen months. Both nerves atrophic and cupped, tension 45 (McLean), vision R. 20/200; L. counting fingers at 3 inches. A Lagrange operation was performed on the right and a trephine with iridectomy on the left. Tension R. 17; L. 9, vision R. with correction 20/40. From a review of 89 cases operated on in 11 years and seen after 2 to 7 years, **Morax** and **Fourriere** conclude that the Lagrange operation has justified the hopes of it for chronic glaucoma.

Holzer reported a case of chronic simple glaucoma, on whom he performed *iridotasis.* The patient was a man 64 years of age, who came complaining of gradual loss of vision for the past three or four years. Vision R. 0.; L. 5/60; Tension, R. 52; L. 46 McLean). The operation was done on the left eye under a local anesthetic, preceded by morphin and hyoscin. The result was vision of 5/10—2 with correction, and tension 22 mm. Hg.

Karelus reports favorable experience with the posterior sclerotomy of Wicherkiewicz in cases of chronic glaucoma. Of 69 such cases, 60 were recorded as having a lasting improvement of visual acuity and of the visual field. In 7 the glaucoma appeared to be arrested, while in 2 it continued to progress. The operation is done by dissecting up a conjunctival flap over a convenient portion of the sclera and making four or five meridional incisions about 2 mm. apart to the depth of three-fourths of the thickness of the sclera.

Morrison finds that in cases of simple glaucoma without elevation of tension, trephining is of no benefit. In cases of glaucoma with intermittent high tension, 30 per cent of the patients are benefitted. In those with constant high tension and in cases of congestive glaucoma, marked benefit occurs in 80 per cent. Except in cases of acute glaucoma or when the patient is very nervous, Morrison performs the operation in the office and allows the patient the greatest freedom.

Tooke states that one of the greatest difficulties encountered in trephining has been to keep the patient looking down. The following method of control has been used with marked success. After anesthetising the conjunctiva and cornea, a few drops of a 2 per cent anocain solution is injected into the lower lid. Two needles are threaded upon a strong silk suture. The needles, which must be moderately long and curved, should be inserted in a horizontal direction at the limbus of the cornea below and should include some of the episcleral fibrous tissue, very much as in the case of muscle advancement. Then the needles should be passed in a vertical direction beneath the bulbar conjunctiva as far as the lower fornix, being brought forward thru the skin surface of the lid in a line with the lower margin of the orbit. Traction is made upon the two ends of the suture until the globe is drawn down into the desired position, and the suture is tied over a small piece of rubber tubing, thus fixing the eye so that the patient cannot move it during the operation. Tooke also advises placing the trephine opening entirely in corneal tissue. He has a special dissector for splitting the cornea made of a Beer's knife.

Brandt reports from the Heidelberg clinic 643 operations on 408 patients, of which 375 were trephinings, 189 iridectomies, 34 sclerotomies. For simple glaucoma 177 trephinings were done on 146 eyes. Arrest of the process followed in 123; but in 9, altho the pressure remained normal, vision decreased to less than counting fingers. In 14 eyes the result was bad. In 66 eyes, seen one to three years after operation, the arrest of the process continued in 79 per cent. There had been four cases of late infection. **Wolfrum** has written on the Elliot operation for detachment of the choroid.

Klainguti thinks the disadvantages of the old hand trephine are removed in the use of the electromotor trephine. Thru increase of rate revolution, the pressure on the eyeball can be absolutely controlled and reduced to a minimum. The machine is on the order of the "electric borer" of the dentist. It consists of (1) the electric motor in form of a spherical metallic capsule which moves on an adjustable support; (2) the boring tube, and (3) the hand piece. The trephine rotates in the latter and is easily removable, so that a larger or smaller knife can be inserted. The author used a 1.5 mm. trephine. There is a circular groove 2 mm. from the crown for adjusting the depth to which the trephine shall go. The number of revolutions varies from 1,500 to 6,000; a good average being 2,000.

Smith has used the trephine operation extensively and has found the results better than some statistics would lead to expect. This operation is easier to perform than iridectomy. He thinks that more stress should be laid in this operation on the reflection forward of the subconjunctival tissue with the conjunctiva. **Steinert** has recorded the results of trephining in 429 eyes at the Leipsig clinic, of which 175 remained under observation more than one year. Late infection occurred in 12 cases. **Thurston** has written on trephining in South Africa.

Teulières and **Pesme** consider that at the present time the value of the fistula method for the cure of chronic glaucoma has been definitely established. Two general tendencies are evident, that toward making the fistula by trephining and that by scleroiridectomy. Because of numerous failures reported in the literature and their personal experience with the trephine operation, the authors have been led to utilize by preference the scleroiridectomy. **Andrade** has written on the surgical treatment of glaucoma.

Menacho states that iridectomy is generally more serviceable in the acute, subacute and chronic inflammatory varieties; less so in the hyperacute and simple chronic forms of glaucoma. It is more effective when done on irides whose texture has not been much altered. For grave cases subconjunctival sclerectomy is preferable. The operation should be done on the part of the iris which is least affected, and not invariably in the highest portion. A well born cicatrix is most likely to be produced in healthy tissue. In menacing conditions, early iridectomy should be done. This rule is applicable to the healthy eye of a patient who, has sustained glaucoma in the other eye, should the slightest prodromes appear.

Mattice reported the case of a man, 72 years old, on whose right eye an iridectomy had been porformed six months previously. Vision at the time of operation was 26/50; tension 70 (McLean). Vision now 20/50 plus 2, tension normal. Mattice believes that iridectomy should always be first tried when extraction is also to be considered. In discussion Swift said he preferred trephining at the upper limbus, and considers iridectomy dangerous on account of possible hemorrhage. Wurdemann prefers the trephine operation when done upward with a thick flap. The Lagrange operation he thinks the most difficult, causing the greatest operative trauma.

In the case reported by **Jacqueau** and **Lemoine,** there had been bilateral iridectomies, then a sclerectomy was twice performed on both sides, and later the cysts formed by the latter operation three times punctured. In spite of all this, the tension remained high and blindness ensued. In the discussion, posterior sclerectomy and repeated equatorial puncture were advised.

In order to avoid too sudden decompression, **Cantonnet** employs a 2 per cent solution of nitrat of pilocarpin. The lower lid is held down and a drop of the drug instilled every thirty seconds for ten minutes. This treatment is kept up at half hour intervals for half a day or a day. If the tension is reduced the next day, the number of drops at each treatment is reduced, and the interval between treatments lengthened. When the tension is reduced in this way, iridectomy may then be done successfully.

Bickerton reported a series of cases of chronic noncongestive glaucoma, upon whom he had performed *Herbert's small flap operation* with favorable results. This brought out an interesting discussion, in which Stevens said that his operation of choice in this disease was the Elliot trephine. He began using it in 1911 and from that time to the present his results have been 30 per cent entirely successful; 50 per cent partially successful, and 20 per cent failures. The latter included failure of the anterior chamber to reform, blocking of the trephine hole with uvea and retinal hemorrhages. He has had no case of late infection. He uses a 2 mm. trephine. Clegg, after an analysis of 247 cases of trephining of his own, reported successful results in 80 per cent. He had had two cases of panophthalmitis after a considerable interval. He also uses a 2 mm. trephine and cuts off the anterior 2/3 of the disc. He considers the scotometer a most valuable means of ascertaining whether a case is progressive or not. Jones in discussion thinks that in this class of cases we ought to operate early when a small iridectomy would give good results. One of the advantages of the Elliot operation was that it could be repeated.

Erlangen reports bilateral infection seven years after trephining. After treatment with injections of aolanin, aspiration of the vitreous and iridectomy, the final visual power permitted counting of fingers at 2 m. Apparently the infection was favored by a cushioned shaped scar, which included a bead of vitreous, by the site of the operation which was below the horizontal meridian.

Elschnig attributes the relative frequency of late infections following trephining, not to the thinness of the conjunctival transplant covering the fistula, but to the absence of an adequate vascular supply in the trophically injured conjunctival tissue. **Rebay** reports luxation of the crystalline lens, causing a permanent scleral fistula following trephining.

Komoto reports two cases of *late infection* after trephining. In one case the infection was mostly in the anterior chamber, so that with a broad incision thru the limbus a good result was obtained. The infection in the second case was back of the lens, and the pus infiltration could be traced from the place of trephining to a cleft between the vitreous and ciliary body.

In order to avoid late infection, **Batten** thought the operation should not be considered an easy one. A perfect technic should be cultivated and, consistent with good work, the operation should be done as quickly as possible. The flap should include all the tissues and should not be bruised. Any local septic focus should be searched for. When he knew the staphylococcus albus was obtainable from the conjunctival sac, he refused to operate. As an antiseptic lotion, he advised a 1:10,000 solution of oxycyanid of mercury used nightly in an eye bath.

Pillat reports the demonstration of the fistulization of the sclera after Elliot trephining by the use of fluorescein, causing a faint green coloration to appear in the scar, especially after pressure with the fingers on the eyeball. **Mueller** demonstrated a case in which the piece of cornea removed by a three millimeter trephine from the eye suffering chronic glaucoma was transplanted to its fellow, which was the seat of total leucoma, giving after three weeks vision = 3/36. A method of entering the anterior chamber for iridectomy, or with the trephine operation thru the upper lid, has been worked out and applied in 16 cases by **Sachs.** The reason for such a procedure has generally been severe infection and inflammation of the conjunctival sac. He has based it on Czermak's operation for extraction of cataract in such infected cases. The tissues are entered near the outer orbital margin after infiltration with cocain solution, and from this point are tunnelled to the site of the corneoscleral opening.

Hepburn reports an experience of 140 trephine operations for glaucoma. He believes it the ideal operation and the earlier undertaken the better. In acute and secondary glaucoma, good results have seldom been obtained; there is too much congestion about the limbus and this encourages healing of the trephine opening. In acute glaucoma he does not trephine unless the tension becomes normal before operation. In order to get a thick conjunctival flap, he dissects down to the sclera and includes the episcleral tissue with conjunctiva. In applying the trephine he places it on the sclera and slides it downwards until it is in contact with the flap. Having once got the trephine to bite, he never removes it. The guide to the penetration of the sclera is the pupil coming up toward the hole. As soon as the iris presents, it must be dealt with at once, and the disk may be left to take care of itself. He grasps the iris with fine straight forceps, pulling downwards and forwards.

Spital, in writing on the filtrating capacity of Elliot's trephine scar in acute glaucoma, secondary glaucoma, glaucomatosis, iritis and buphthalmos, concludes: In chronic glaucoma the pressure decreasing action of Elliot's trephine operation certainly rests on the filtrating capacity of the scleral scar, whereby new routes for drainage are secured, and the peripheral iridectomy performed at the same time has no direct effect on the disease in pressure. In acute glaucoma, secondary glaucoma and glaucomatous iritis, in addition to this action the opening up of the natural drainage thru Schlemm's canal by the peripheral iridectomy is also a factor in the establishment of free drainage. In buphthalmos neither of these factors can be effective.

Ellett reported a case of bilateral acute glaucoma in which he had done a trephine and iridectomy five and one-half years before. When first seen the fields were contracted, vision 20/30 with correction, and without eserin the tension was 57 mm. Now vision is 20/25 in each eye with correction, and the tension is R. 20; L. 17 mm. Hg. The fields are exactly the same as they were two months after the operation. He attributes the good results to the iridectomy.

Birch-Hirschfeld reports an expulsive hemorrhage after an Elliot trephine operation, in a woman 67 years old. In spite of great care, a hemorrhage occurred 25 hours later, as a result of which the retina was expelled thru the trephine opening. The retina presented three different anatomic pictures: (1) Structure entirely normal; (2) structure markedly altered; (3) structure so changed that retinal tissue could not be recognized. The most marked changes were to be seen on the edges of the preparation where, apparently, compression and friction against the margins of the trephine hole were strongest. The different retinal layers could not be made out. It presented one cord like mass of tissue full of cavities and cracks, which were filled with irregular layers of glia cells and broken down nerve cells. Underneath the epithelial layers, there were several large sized hemorrhages. The author believes, that prior to the operation there was extensive disease of the walls of the vessels in the choroid and retina which, owing to the patient's hypertension, led to rupture at a time when the bulb was relatively hypotonic, and the increased intraocular tension could not counteract mchanically the onset of a hemorrhage. The operation, he believed, acted as an exciting cause in an individual predisposed by age and vascular disease to retrochoroidal hemorrhage.

Tresling tabulates the findings in thirteen trephine cases of glaucoma reexamined years later. He was surprised to find that vision had progressively declined, and the visual fields became more and more restricted with the passing years.

Crystalline Lens

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This review of this subject carries the literature from May, 1921, to May, 1922. For previous references see Ophthalmic Literature, 1921, v. 17, p. 193.

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DIGEST OF THE LITERATURE.

EMBRYOLOGY.—Connective tissue particles were bred in the vitreous of the eye in tadpoles of Rana temporaria and the results observed by **Petersen.** A tarsus epiphysis was implanted in the vitreous body, the wound remaining open. The edge of the wound formed an epithelial seam which showed a typical lens globule in one place, the form and structure corresponding to the well known lens regenerations of the iris. What developed from the wound of the bulb in the region of the retina may be designated as a maturing of the wound into a pupil, with a sort of auxiliary iris and a lenticular predisposition that put this iris into the apparent pupil. In this case the position of the lens globule in the region of the pars optica retinae is both new and important. The material seemed to come from the pigment epithelium.

The noteworthy fact in the first case is the completely unimpaired condition of the pupillary region of the eye with the old lens. This nullifies all theories which seek a connection between the introduction of the lens forming powers and the loss or absence of the old lens or any lens at all. The absent pressure of the old lens as a releasing factor is also dubious. There is really no regeneration or actual restitution present, as nothing is missing, and a lens is unnecessary. Even with the so called supernumerary regeneration there is no connection. The nearest might be that of the supernumerary planary heads and tails.

The hole in the bulb is treated by the living organism as an injured pupillary end with a deficient lens, upon which the system may react instinctively. The similarity to aimless reactions of animals and human beings seems to be more than pure analogy: there being an important connection with the problem of vitalism. Form building processes as well as actions and instinctive behavior must be considered as part of the conception of regulation, while disturbances and vital differences are to be equalized.

Mann after reviewing the literature upon the congenital absence of the crystalline lens, reports a case of an aphakic human embryo of 13 mm. A well formed optic cup occupied its normal position. The choroidal fissure was still open with the lips of the fissure almost in apposition. The fissure, however, did not extend into the optic stalk. The blood drainage and retina were normal. There was no trace of a lens beyond the presence of a very small blunt pointed epithelial projection from the inner side of the surface ectoderm, almost in the middle of the pupil. It affected the deep layer of the ectoderm only, and was not accompanied by a corresponding depression on the surface, which possibly represented an abortive attempt at a lens thickening. It seems to prove that aphakia can occur as an isolated malformation, and offers confirmatory evidence on the power of self differentiation possessed by various organs.

Composition of Lens.—**Goldschmidt** determined the lipoid content of the lens by fractional extraction. He notes that the lipoids generally increase with age, the cortical zone of a cataractous lens containing more than the nucleus, and also more than a normal lens which indicates a decrease of the internal respiration of the cataractous lens.

Jess determined the amount of lysin, histidin, arganin, valin, alanin and cystein in the proteids of the crystalline lens. Histidin and lysin were found in equal amounts in normal and in cataractous lenses. Valin and alanin were diminished, arganin and melanin increased and cystein not present in cataract.

Jess states that modern albumin chemistry investigations have shown that the albumin of the lens does not contain glycocol. Albumoid, which constitutes the bulk of the albumin content of the cataractous lens, contains little valin and alanin and no cystein. B-crystallin, the protein which disappears while a clear lens is becoming cloudy, is not only rich in cystein, but also contains valin in larger quantities than A-crystallin, and ten times as much as albumoid; at the same time the B-crystallin contains less leucin. The latter contains a higher ammonia content and only small traces of melanin.

In further experiments, **Jess** was able to ascertain by quantitative albumin determinations of numerous normal and senile cataractous cow lenses, that in the four kinds of albumin in the lens cited by Morner, the water soluble proteins vanish with the appearance of the cataract, but the water insoluble albumoids may even be increased. Furthermore, he could determine that the so called cystein reaction which disappears in the cataractous lens, is bound principally to the water soluble, socalled B-crystal, and in lesser degree to the crystal itself. The latter might thus lack the cystein, which must be considered as one of the constituents of some proteins, for only this separation product gives the socalled reaction.

It seemed of interest to decompose the individual lens proteins, about which only their elemental composition was known to date, and, with the aid of modern physiologic-chemic methods, to look for the differences in the individual amino acids. After the production of a sufficiently large number of X-, B-crystal and albumoids, the author established the monoamino acids by the Emil Fischer Ester method. These experiments showed that glycocol was missing entirely in the three lens proteins, and that noteworthy differences exist in the structure of several other constituents, especially alanin, valin and leucin, and particularly between the albumoid and the B-crystal. Alanin and valin are low in albumoid, while less leucin could be extracted from the B-crystal. Mention is made of forthcoming papers on the appearance and amount of diamino acids and of the cystein, as well as the chemical composition of other organs of the eye.

Peters found that twelve out of the 26 cataracts examined histologically were purely epithelial in origin. These were all anterior cataracts, the result of inflammatory changes or injury. Their cells stained like corneal epithelial cells. The remaining 14 cases were more or less extensive cataract formations in various ocular affections, and stained entirely differently from the first 12 mentioned. Further investigations of this material showed that there are cataracts, purely epithelial in origin, in which organized connective tissue can only be found in the capsular sac when the cataract has proliferated directly into the sac thru rupture of the lens capsule.

Staining results in some of the other cataracts showed that the cataract tissue could not have been produced by any inflammatory process. The fact, however, that the staining properties of some cataracts are the same when they are due to inflammation as when they are due to trauma, seems to speak for a uniform mechanical cause of cataract formation: the difference being merely as to the nature of the albuminous mass which enters into the structural formation of the cataract. Whatever this difference may be, future investigations must decide.

Balling reports studies in chemistry of the cataractous lens in the human eye.

ANOMALIES.—**MacKenzie** reports two cases of *lenticonus*, one occurring in a patient of 62, believed to be a posterior lenticonus, probably pendulous because the patient's vision varied with change of position. Riders were present and a floating vitreous. The second case reported is one of anterior lenticonus. Under a midriatic, the shadow appeared to occupy the central pupillary area when viewed from the front.

Clemesha's case of posterior lenticonus occurred in a boy of 12. The patient presented a luminous disc in the center of the pupil, sharply limited by a dark border and red periphery. The disc, which was compared to an "oil drop," was not absolutely transparent. Riders were present. **Butler** cites a case of coloboma of the lens, in which there was an unexplained detachment of the lower half of the retina. **Doyne** presented a case of bilateral opacities of the crystalline lens. In one of the eyes, crystals were to be seen situated in the anterior portion of the lens. These crystals showed prismatic colors when viewed with oblique illumination.

Prevedi observed in a man of fifty-nine, a delicate thread running from the lower outer quadrant of the lesser iris circle to the anterior surface of the lens. There were two other fine threads on either side of this, arising from the lesser circle and ending free without touching the lens. Two fine points were seen on the lens surface, however, where they had probably been attached. A delicate membrane could be seen adherent to the iris. Except in the location of the large thread mentioned above, this extended in only to the greater iris circle. While the appearance of the threads in the pupillary space is not very infrequent, the membrane on the iris surface is rare and may throw some light on the origin of pupillary membranes and reasons for their persistence.

The theories which have attempted to explain this are discussed. Most of them, in the author's opinion prove unsatisfactory for one reason or another. It is probably true, however, according to Jannulatos, that the normal pupillary membrane disappears at the time when the vascular lens capsule absorbs, due to cutting off its vascular supply. The author thinks that when this vascular lens capsule completely disappears, all of the ordinary membrane must be absorbed, except where part of it is supplied by an anomalous blood vessel entering it from the iris itself; this blood vessel being entirely separate from the lens capsule, and so accounting for the persistence of parts of it, as in the case described.

PHYSIOLOGY: ACCOMMODATION.—**Lewis** reports a case of a patient of 51, who was operated on for congenital cataract in early life, who was able to read J. No. 1 at 7 inches with both eyes and J. No. 1 at 9 inches with the left eye, and has an apparent accommodative range of about 9 inches, which is brought about by a conscious effort. The author explains this phenomenon by assuming that the vitreous varies in density as in the ox. By a segmental pressure of the ciliary body on the vitreous, the vitreous is pressed forward into the pupillary space, thereby giving it increased curvature on its anterior surface.

Fringer reports a case of a 53 year old woman who was able to read J. No. 4 and No. 3 at 16 inches with her distance correction, which was O. D. + 11.00 sp. ⊃ + 0.75 cyl. ax. 120, and O. S. + 10.50 sp.

White presented a patient upon whom a cataract extraction had been done 15 years previously, who with her lenses had 20/20 distance vision and was able to read J. No. 1. There were two other cases in the same family with a similar condition, upon whom different types of operation had been done.

DISLOCATION OF LENS.—**Finnoff** presented a case of bilateral *congenital dislocation* of the crystalline lens occurring in a boy, the right dislocation being up and out and the left up and in. The iris was pushed forward against the posterior surface of the cornea, and was fixed at this point, altho the remainder of the iris was tremulous.

Butler performed bilateral extraction of crystalline lenses dislocated downward: preliminary iridectomy having been done at a previous operation. The author emphasized the necessity of preliminary iridectomy and advocates a horizontal incision ending well forward in the cornea. He calls attention to the necessity of condensed illumination as by "point-o-light" lamp.

Babonneix presented a child of nine years with right infantile, cerebral hemiplegia and double congenital cataracts of the zonular type. This is an unusual association, not previously reported. The cause was unknown, altho hereditary syphilis was suspected but not proven.

Roche reports double dislocation of lens into the anterior chamber in a child of 5 years. Discission was done on one eye under a general anesthetic, after fixation by a needle. Aspiration of this mass was performed several days later, and later discission of the other eye. The case was not seen for 3 1/2 months, at which time *glaucoma* had developed, and the eye was lost. The lens was extracted from the anterior chamber. The operation controlled the pain but vision was not restored. The eye subsequently had to be removed because of iridocyclitis and atrophy. The author believes the case to be one of congenital dislocation, with a background of syphilis, supported by other physical findings despite the negative Wassermann. He advised the early extraction of lenses dislocated into the anterior chamber, because delay exposes the patient to glaucoma.

Garzon Maceda reports a case of spontaneous luxation of the crystalline in a boy who had previously been myopic. The parents and other members of the family were free from such defects. The lens was in the anterior chamber, from which it was extracted after instillation of pilocarpin.

Garcia Mansilla reports a case of dislocation of the lens into the anterior chamber successfully extracted with an iridectomy. Three cases of congenital luxation of the crystalline lens are reported by **Santos Fernandez.** The first, in a man of 36, treated by extraction of the lens after an upward iridectomy, presented an excellent result when seen 9 years later. The others occurred in a boy of 11 and a man of 30. He calls attention to the recent study of this condition by slit lamp microscopy.

Palacios examined a child of five years, who presented double dislocation of the crystalline lens backward. A similar condition existed in the child's father. The author discusses the general treatment of subluxation.

Bichon reports a case of bilateral dislocation of the crystalline lens, the right eye being affected first and the left eye two years later. The right eye showed a posterior staphyloma with complete atrophy of the optic nerve. Extraction of the left lens improved the vision of that eye. The displacement of the lens was complete in both eyes, into the vitreous in the right, into the anterior chamber in the left.

Putnam cites an instance of bilateral dislocation of the lens in a 48 year old patient, which immediately followed a severe fall. The left lens became dislocated into the anterior chamber, setting up an attack of acute glaucoma. Attempted extraction failed, but a wide iridectomy was done and finally the dislocated lens absorbed, with resulting corrected vision of 20/70. Later the right lens became dislocated into the anterior chamber. Extraction was done, giving corrected vision of 20/40.

Albright saw a patient 70 years old, who had a subconjunctival *traumatic dislocation* of the crystalline lens, which, from the history, appeared to be the direct result of a blow four years previous. Sixteen years before the accident, an iridectomy for glaucoma had been done on the injured eye.

Lawson reports the case of a dislocation of the crystalline lens backward into the vitreous, following a blow. Several weeks later, the eye developed acute *glaucoma* at which time the lens fell forward into the anterior chamber to almost its normal position. Coincident with the dropping back of the lens in the vitreous, the tension was reduced to normal. The author notes that cases of swinging lenses are rare.

Bane presented a 24 year old patient with bilateral dislocation of the lens downward. Four months previous the patient received a severe blow on the back of head and a kick in the left supraorbital region. Blurring of vision was noticed three days following the accident.

In **Stieren's** case there was a traumatic dislocation of the lens into the vitreous in a myope of 12 diopters. The lens gradually absorbed until only the capsule remained. An increased tension, following the blow, was controlled by miotics.

Anatomic examination by **Wessely** of an eyeball in which there had been spontaneous dislocation of the lens into the anterior chamber, showed that the lens was still suspended on some fascicles of the zonula, which were stretched to an extraordinary length. It is possible that this condition is responsible for the secondary glaucoma which is so often observed in similar cases. He believes the tension of the zonula exerts pressure upon the ciliary body.

CONGENITAL, HEREDITARY AND FAMILY CATARACT.—**Ellett** presented a boy of four years of age, with zonular cataract, upon whom a free discission had been done five days ago. A much swollen lens and opaque nucleus lay in the anterior chamber without causing reaction. **Zentmayer** presented a 12 year old boy with no history of trauma or tetany. Patient's grandfather, father, an aunt, an uncle and two paternal cousins had congenital cataracts. In both crystalline lenses, there was an irregular disc shaped, chalky white area surrounded by grayish zone. Beyond this, the margin of the lens and zonule was plainly visible.

Zentmayer showed typical coralliform cataracts in a child of seven. He called attention to Verhoeff's finding that these opacities are made up of crystals. Altho corrected vision was 5/20 on the right and 5/15 on the left side, the patient was unable to continue studies. Therefore operation seemed defensible.

Friede illustrates a case of unilateral, perinuclear cataract occurring in a boy of twelve years old, which followed a trauma at the age of two years. Both corneal centers showed several superficial spots. In about the center of the lens capsule an opaque, white ovular spot was found, with pigmented dots, apparently due to injury of the lens capsule. From this point, a thread like brownish black pigment band is seen in the middle of the nasal one-half of the pupil. The lens contained a fairly opaque cataract about five mm. in diameter. When examined with a corneal microscope, it was seen that almost immediately next to the opaque, cup like cloud, a second delicate grayish-white layer was formed.

A healthy girl of 14 years was reported by **Harman** with a negative family history. In the deeper layers of each lens, there was a small sharply defined thin opaque disc. Corrected vision of the right side was 6/18 and the left 6/12.

Clegg and **Renwick's** patient was a boy of eight years, who received an injury over the left eye as result of instrumental delivery. There was no history of rickets or convulsions. There was a partial lamellar cataract with two fine threads running from the center of the lens to the circulus minor. Pupil was round, dilating well under midriatics. Two illustrations accompany the article.

After noting that the most common type of cataract seen in children is the lamellar, and discussing the well known etiologic factors, **Tivnen** cites an instance of a child, 20 months old, presenting symptoms of cerebral palsy due to defective glandular secretion. In order to decrease the size of a large persistent thymus gland, X-ray treatments were given at intervals for twelve weeks, at which time the gland had apparently disappeared. Coincident with this, there was a marked improvement in the child's general condition. Symptoms of thymus disease and treatment were discussed, and stress laid on the fact that in patients suffering from thymus disease, anesthesia and operations readily induce death. The author urges the necessity of careful examination as a routine procedure for the presence of enlarged thymus gland.

Smith says that in his observation congenital cataract is usually hereditary. He finds it frequently associated with microphthalmos in varying degrees. The prognosis should always be guarded. He finds lenses large, in proportion to the size of the cornea. The author urges operation in these cases, and advises extraction in the capsule in patients who have reached middle life.

Stein describes, with a photomicrograph, a lamellar cataract from a pig's eye. The microscope showed extensive destruction of the lens fibers in the nuclear region. The nucleus lay at the posterior pole. The lens capsule was incomplete in this area. As all sections showed this defect in the capsule at the posterior pole, it would seem that it was due to defective constriction of the vesicle, rather than to an artificial tearing of the lens capsule.

Koeppe believes if the Gullstrand slit lamp shows fine, sharply defined, greyish white points, of equal size and glistening in direct light, which are scarcely or not visible in indirect light, it may be supposed that they are congenital formations; (a) if the cataract of Vogt, especially myelin drops can be excluded, which appear dark in indirect light; (b) the slit lamp and the clinical condition do not reveal the manifold changes described by Vogt in the incipient or progressive coronary and senile cataracts, especially the fine myelin drops, and (c) if during longer observation the opacities do not progress.

Lohmann reports three cases of partially developed lamellar cataract. He thinks that a local disturbance during the embryonal development of the lens is responsible for the condition. The irregular form of the inner border of the cataract is not caused by a process of contraction, but is due probably to peculiarities of the first "anlage."

Lievens performed a simple extraction for socalled pyramidal zonular cataract in a boy of 7 years. The cataract in the pupillary center represented a white cone almost touching the posterior surface of the cornea. Visual acuity of only 1/10 resulted, because of iris adhesions. The author used a different procedure for the remaining eye. Histologic study of the cataractous cone, removed with forceps, shows that the capsular epithelium proliferates in the form of spindles, constituting a dense callus under the raised capsule.

Andrassy notes that cataract frequently appears with congenital or other inheritable diseases, which suggests the possibility of disturbance of the internal secretion as a cause. In a general way, gray cataract is inherited and conforms to Mendel's law. First children are more apt to be free from cataract than those later. Normal children are seldom born between children with cataract. A family tree is given thru six generations, in which there was not only cataract, which appeared at an earlier age in the later than in the earlier generations, but also rickets and psychic abnormalities. There was apparently a congenital defect of the lens, with a tendency to defective bone growth and psychic disturbance, probably due to abnormalities of internal secretion.

Lamellar fissure, first described by Vogt, is quite frequently observed in senile lenses, and is therefore an important and characteristic change in senile cortical cataract. **Schild** examined 111 otherwise normal patients. Lamellar fissure was not demonstrated under 50 years of age, but rose to over 50% beyond 80; and was more frequently found at an earlier age in women than in men. The fissure was usually bilateral, generally in the posterior third of the anterior cortex. When unilateral, the corresponding area in the other eye showed water clefts and wedge shaped opacities. The percentages of the various types are quoted. The combination of lamellar fissure with radiating fissures supports the theory that living lenses like dead ones take up water. In the posterior cortex, the condition was found in only 5% of cases, all of which also showed cortical changes.

Pfeiffer examined 219 eyes, in 11 individuals, with the slit lamp in order to study water fissures. The statistics showed 28% of unilateral and 58% of bilateral water fissure, beginning over 50 years of age and increasing in numbers with age. In 94% they were anterior and 44% posterior, while in 5.45% of the latter was the anterior cortex involved. While appearing in all layers, they were generally found in the middle and deeper, near the nucleus. Superficial and subcapsular fissures are rarely single. The forms of lumen on cross section are varied. Because of the association with other opacities, it is difficult to say which is primary, but the author concludes that fissure formation is always preceded by opacities.

PATHOGENESIS OF CATARACT, SPECIAL CAUSES.—**Hektoen** has shown that the precipitin reactions of the lens of certain mammals (and of the chicken) are lens specific; and the lens, at least of the mammals in question, does not appear to contain any species specific precipitinogens: hence the lens protein may be regarded as chemically distinct and as identical in diverse species. No lens antiserums react with the blood serum of either the corresponding or any of the other species represented, and no serum antiserum reacts with any lens solution. The humors may sometimes react with serum antiserum. The presence of lens substance in the vitreous and aqueous humors raises interesting questions with regard to the relations of these humors to the lens. In the absorption experiments made, the solution of any lens of those used in immunizing the rabbits removes all the precipitins from any of the lens antiserums mentioned.

A lens antiserum produced by injecting a rabbit or guinea pig with beef lens, will react in precipitation, anaphylaxis and complement fixation tests not only with beef lens, but also with the lens of other mammals, of birds, and of amphibiæ. With fish lens the reaction, however, is very faint. The specificness of the reaction is determined not by species, as in other immune reactions, but by the organ from which the antigen is derived. So far the lens is the only clean cut example of this organ specificness, as contrasted with the species specificness. The aqueous and vitreous humors contain lens substance, because these fluids in low dilutions or full strength react with lens antiserums. The presence of lens substance in the humors is interesting, and the question arises whether the lens substance in the humors is derived from the lens or on the way to be incorporated into the lens.

Schoeppe concludes: (1) There is no difference in the biologic relationship between the serum and lens albumin in individuals with senile cataract and those free from cataract. (2) Neither the serum of individuals with senile cataract nor that of individuals free from cataract has the property of breaking down lens albumin.

Kirkpatrick asserts that most of the morbid conditions which are associated with the development of primary cataract injuriously affect the action of the endocrin glands. Primary cataracts sometimes follow thyroid and parathyroid deficiencies, and are almost certainly then caused by a disturbance of endocrin function. Exposure to injurious heat and light rays and the existence of an uncorrected error of refraction are likely to determine the formation of a cataract in the eye of a person who is predisposed to a degenerative change in his lens fibers by a constitutional defect.

Howe quotes the method of Guyer in the production of experimental blindness. An emulsion of the lens substance from rabbits was injected into a fowl until the fowl became sensitized. A female rabbit, supposed to be pregnant 10 to 15 days, was injected with the serum from the sensitized fowl with gradually increasing doses. Many of the offspring were found to have defective vision and complicated cataracts.

Hesse reports four cases of Vossius' annular lens opacity in which hemorrhage preceded the appearance of lenticular opacities. In one case a typical lens opacity was observed after a spontaneous hemorrhage, in the absence of trauma. He notes that an annular opacity is disc rather than ring shape, with the borders more dense. He believes the condition due, not to contusion, but to hemorrhage into the anterior chamber.

Von der Heydt calls attention to the fact that under coronary or wreath shaped cataract should be grouped the types of lens opacities including the cataracta punctata and also cataracta cerulea or viridis, which originate in the periphery in a zone at the junction of the middle and outer thirds of the radius of the lens. In the beginning, these opacities are club shaped, the rounded end showing an abrupt termination axisward. This type of cataract slowly increases over a long period of years, without affecting visual acuity, owing to their marginal location. Coronary or wreath shaped cataract is considered extremely hereditary. The author reports six cases. He says that in coronary or wreath shaped cataract, we have a very common progressive, hereditary, peripheral lens clouding, occurring in adults, and it may now be classified as a definite clinical entity.

Gallus reports five cases in which the development of cataract preceded the onset of diabetes from 2 to 17 years. He concludes that cataract in diabetes is, therefore, not a consequence of the constitutional disease. It must rather be assumed that the disposition for each is independent of the other.

Lippmann discusses the results of operation on *diabetic cataract* at Prague clinic during the past ten years. Fifty-three of the patients were over, and 10 under, 40 years of age. The number of complications during convalescence and the number of secondary operations necessary was fewer than in ordinary cataract operations. Because of danger from coma, operations should be performed only on individuals with acetone free urine. The operative prognosis on young patients with diabetic cataract is, on the whole, favorable; tho from the number of deaths, despite careful treatment, it must be admitted the appearance of cataract in young diabetics is a very serious symptom.

Matthews reports a case of a 23 year old woman, part of whose thyroid was extirpated in 1913 and the remainder in 1917. The following year vision became blurred. The ophthalmoscope showed great tortuosity and dilatation of the retinal vessels. Under potassium iodid for five months, vision was restored to 20/20. Five months later, diffused central opacities with radii developed, despite the fact that the patient had been taking thyroid extract intermittently, since operation. The author referred to a similar case reported by Jeremy in 1919 and recalled cases published by Schiller, Czerny and Westphal.

Vogt has seen four cases of *myotonic* dystrophy and has knowledge of four others. Examined by a slit lamp, white, triangular dust like opacities, belonging to the cortex, are seen mixed with red, green and rarely yellow and blue crystals. The author considers the appearance of these crystals, which are probably cholesterin, as characteristic of this form of cataract.

Strebel applies to cataract, in general, what has been learned from cataract following electric accidents. He advises extraction from this cause as early as possible in order to prevent blindness. In one of his cases, bilateral cataract developed in three weeks, in another the interval was six months in one eye and two years in the other.

Becker reports bilateral cataract and secondary glaucoma in a patient who had come into contact with an electric current of 60,000 volts. He received severe burns on various parts of his body. Shortly after, opacities developed in both crystalline lenses, which became total in 3 1/2 months. Swelling of the lens induced secondary glaucoma, which was relieved by iridectomy. Subsequent extraction was followed by perfect vision with correcting lenses.

A girl of 13 was seen by **Tiscornia** who was rendered unconscious by lightning coming down a chimney. There were no burns or other physical disturbance except congestion of the globes and lids and a photophobia persisting for about two months. A year later, bilateral cataracts developed which were operated upon 4 years later. He quotes 20 cases of electric cataract found in 34 publications in 36 years, but lightning was responsible for only 10 of them.

Van Duyse and **Danis** cite an instance of a patient, who was struck in the eye by a fragment of casting two years previous. Altho no scar of entrance or foreign body could be observed, the crystalline lens was opaque with brownish spots arranged in the form of a circle on its surface. Details are given concerning the siderosis spots underneath the anterior capsule, the pigment spots upon its external surface and the cataract. The authors conclude that a metallic article is fixed in the anterior layers of the crystalline lens or in the vitreous, and note that injuries of this sort are exposed to later complications. The literature on the subject is reviewed.

Radcliffe presented a boy, who developed cataract after a blow across the face with a lash. Bilateral extraction was done with a keratome and satisfactory vision resulted.

Two years ago **Bleisch** examined a case which showed under lateral focal illumination a disc like opacity of the lens with brown discoloration of the center. With the ophthalmoscope, the opacity was almost invisible. At a recent examination, it was found that the disc like opacity had become more pronounced so that the pseudocataract is developing into an actual opacity. A piece of copper was found in the vitreous.

Colombo's patient was injured in a bomb explosion 2 years previously. There was a small coloboma at the edge of the left upper lid and a small scar in the limbus. On the anterior surface of the lens, was a typical Vossius ring. Outside of this, radiating lines could be seen under high magnification. A disc like opacity of 1 1/2 millimeters in diameter occupied the center of the ring. Colombo discusses the literature on the subject and points out that in previous reported cases of Vossius ring, the opacity disappeared in 60 days, and calls attention to the remarkable coincidence of the two lesions. A bibliography is appended.

Among the comparatively small number of "puddlers" now employed, **Cridland** found that cataract is not uncommon, and those observed by the author were typical of the variety known as "glass workers'" cataract.

Twenty-five cases of cataract in men and women engaged in chain making were observed by **St. Clair Roberts.** Opacities occurred in either one or both eyes, of the type described as appearing in glassblowers, namely a posterior polar and cortical opacity. The author notes that the workers wear no kind of protection, altho exposed to the white hot metal while working at an anvil. Many of the patients suffering from cataract were quite young, which is accounted for by the fact that the work is frequently done near the working men's homes, under conditions wherein the mother and children are engaged in the work.

In 1908 the Royal Society appointed a committee to investigate glass workers' cataract. The report submitted by the surviving members states that their investigations show:

(1) That the luminous rays are not the cause of the disease.

(2) That ultraviolet radiation is not the cause, in so far as any direct action upon the lens is concerned.

(3) That the evidence is strongly in favor of the view that heat is the active agent.

(4) That it is uncertain whether the heat radiation acts directly on the substance of the lens, or indirectly by disturbing the nutrition of the lens.

(5) That possibly ultraviolet radiation may play some part in the causation by direct action on the nutrition of the lens.

It is pointed out that further investigation of the effect of heat radiation is needed, and further research on the chemistry of the crystalline lens, while the difficulties of producing glass which will absorb radiation are not entirely overcome.

Healy found that 45% of men 35 years of age or over engaged as tinplate millman, had lenticular opacities; whereas in those under 35 years of age, only one opacity was found. The predominant type of opacity was wedge shaped, striated, cortical opacity below, with its apex upward and growing into the posterior cortex. Dense, round, posterior cortical opacity similar to that supposed to be typical of glass workers' cataract, was the most common occurrence. These men handle white hot metal bars with tongs, the eyes being constantly exposed to the glare of the metal. The author believes that his findings support the evidence that this type of cataract is the result of infrared rays rather than ultraviolet. Healy suggests that despite the mechanical difficulties, the wearing of suitable goggles might prevent the formation of this type of opacity.

Tuto comments upon the frequency of penetrating foreign bodies among metallurgic workers and the indifferent diagnosis, resulting from difficulties of proper localization and extraction. He speaks of the need of proper facilities for this work in all industrial centers. Two cases in point are quoted.

TRAUMATIC CATARACT.—**Santos Fernandez** calls attention to the occasional occurrence of injuries to the crystalline lens without cataract supervening. He reports a case of this kind first seen in 1877 and again in 1905. He had encountered no similar case in which the opacity had remained strictly limited to the point of injury. A rare form of cataract produced by contusion of the eye is reported by **Carreras. Cantonnet** has written on the treatment of traumatic cataract.

Collins concludes (1) that it is difficult to draw the line between typical lamellar cataracts and nuclear cataracts occuring early in life. (2) Lamellar cataract is nearly always bilateral and due to some constitutional disturbance. (3) The most characteristic feature found microscopically is presence of gobules in the affected area, which are situated between the fibers. They are either degenerated lens cells which have failed to develop into fibers, or fibers whose development has been arrested. (4) The size of the zone of opacity indicates the age at which the cataract developed. (5) Lamellar cataracts formed before birth are not associated with hypoplastic changes in the enamel of the teeth, but such changes are frequently found when cataracts are formed after birth. (6) Rachitis is a frequent concomitant of lamellar cataract. (7) A history of infantile tetany is common. (8) Parathyroids regulate in some way the calcium metabolism of the body. (9) When hereditary, lamellar cataract may be transmitted by the father, indicating a general cause. Collins thinks that unilateral cases may be due to some local inflammation or injury. He is of the opinion that this type of cataract is not a clinical entity, but may arise from different causes, the essential factors being a temporary disturbance in the lens nutrition ending abruptly and followed by a period of normal growth.

Wirths believes that copper in the eye may act on the lens. He quotes Purtscher and others, who have observed a similar condition. In the author's case, a soldier was wounded in both eyes by the explosion of a detonator. Two years later the left eye became inflamed, and a central opacity was observed which showed radial tongue like offshoots spreading to the periphery, and having the appearance of a sunflower. By transmitted light the lens was perfectly transparent. X-ray examination was negative and giant magnet was negative. A small pigmented scar in the limbus and one deeper in the cornea were possibly due to the passage of a foreign body. Wirths thinks that it is probable that the eye contained a piece of copper.

In **Vogt's** case both eyes were injured by shell explosion. Foreign bodies remained negative to sideroscope and magnet and showed a brassy color. In one a typical Purtscher's cataract developed, while the other one went to complete destruction. By slit lamp microscopy, the cataract was found to belong to a very fine capsular layer.

Rumbaur reports the case of a patient, who five years previously had a penetrating wound, at which time no foreign body could be found. When seen, there was a central opacity of both the anterior and posterior capsule of the lens with iridescence. With corneal microscope and the Nernst slit lamp, a relief like shagreening became visible with deeply saturated metallic colors. The ophthalmoscope showed extensive contusion changes in the choroid and retina. The condition of the lens was considered characteristic of the specific chemical action of an intraocular foreign body composed of or containing copper, and this diagnosis was made altho no foreign body was distinctly demonstrable.

After noting that cataract follows what appears to be relatively minor injuries, **Luc** urges the early extraction of magnetic foreign bodies, and feels that proper medical and general treatment may sometimes forestall cataract formation.

Two cases are reported by **Lampert** demonstrating the importance of the use of the slit lamp and corneal microscope in diagnosis. In one instance, the eye had progressive loss of vision without apparent cause. A slight scar in the cornea was seen, which the Gullstrand instrument demonstrated involving all layers. Near the pupillary border was a small compact mass of brown pigment. In the middle layer, a small foreign body was found, the pathway being revealed by the Gullstrand lamp and by no other means. In the second case, there was found a subcapsular opacity in the lens and a small foreign body located in the anterior layer. With the lamp and corneal microscope, a fine, opaque path was visible.

MANAGEMENT OF INCIPIENT CATARACT.—A radium applicator for cataracts is described by **Franklin** and **Cordes**, consisting of a specially designed silver cup which screens out practically all but the gamma rays. The construction of the applicator is described in detail and also the precise method of applying radium to the patient. The dose is given as 10 milligram hour twice a week for four weeks, and then once a week until improvement is shown. The best results obtained have been in those cases classified as incipient and where vision had not been reduced below 0.5.

Kirkendall comments upon the general inefficiency of medical treatment for cataract in his experience.

OPERATIONS FOR IMMATURE CATARACTS.—**Smith** discusses in a comprehensive manner the various elements of the problem of immature cataractous lens, especially with reference to the surgical treatment. He believes that his own method of preliminary capsulotomy by means of an especially devised needle followed six hours later by extraction of the lens is safer than the intracapsular procedure recommended by Col. Smith. He advocates irrigation with normal saline however clear and black the pupil may appear. In his experience, needling is necessary only in the rarest instances.

After stating that the etiology of cataract is undetermined; it clearly not being a starvation disease or undue exposure to actinic rays, Col. **Smith** discusses the early signs and symptoms of cataract. He claims more success in the treatment of the early cataract by the production of local hyperemia. This was first accomplished by subconjunctival injections of cyanid of mercury; but he has since noted that potassium iodid produces the same results, and he has come to the conclusion that the reagent is of less importance than the fact that something is used to induce hyperemia. Assuming that a special pabulum for the nutrition of the lens is metabolized by the cells in the ciliary region, the cause of the cataract is that these cells have assumed a pathologic condition and issue a pabulum which is not physiologic and not fit to maintain the physiologic nutrition of the lens. He speculates that hyperemia reestablishes the physiologic condition of the metabolizing mechanism.

Smith writes that the earliest symptom of senile cataract is failing distant vision. Sand like particles are occasionally to be seen in the periphery of the lens. This type sometimes yields to subconjunctival injection of cyanid of mercury. The hyperemia thus induced seems to influence the nutrition of the lens.

DISCISSION OF LENS, INDICATIONS, TECHNIC.—In cataract operation on adolescents, **Santos Fernandez** prefers discission rather than extraction, because detachment is more apt to follow extraction than discission. A case is quoted.

In order to escape complications of the present method of performing discission and to hasten convalescence, **Ziegler** advocates a complete V-shaped discission of the crystalline lens. After complete atropinization, the cornea is punctured above with the Ziegler knife needle turned flat. The point is swung to the left of the center and the lens punctured as low down as possible to avoid ciliary injury. With a sawing motion, the lens is divided thru and thru from below upward. The knife is then withdrawn and swung across the anterior chamber to corresponding point on the right of center. The cut is carried similarly upward completing the V. After withdrawal of the knife, the corneal wounds are cauterized with 5% iodin solution. As a rule patients are discharged from the hospital on the fourth or fifth day, and convalescence is complete in about one month. Operative reaction is reported as being slight.

EXTRACTION: THE PREPARATION.—In cataract operation, **Van Lint** uses a 2% novocain to which a drop of adrenalin to each cc. is added. A 3.5 cm. needle is entered 1 cm. back of the point of intersection of a horizontal line, passing the lower margin of the orbit, and a vertical line at its external margin. He injects 2 cc. of the solution to within 5 mm. of the lower margin of the orbit. A second puncture is made 1 cm. above the first. The needle is directed upward, and 1 cc. of the solution is injected as far as the external palpebral ligament. The third puncture is made on a line with the outer terminus of the eyebrow, and 1 cc. of the solution is injected from above downward to the external palpebral ligament.

According to **Colin**, the preliminary preparation of the eye before cataract operation should consist of asepsis of the conjunctival sac by the frequent use of several drops of a zinc sulphat collyrium eight days before operation, and application of iodin solution to the cilia border. On the day of the operation, the lacrimal passages should be syringed with an astringent lotion. Patient should be educated in the eye movements. Sodium sulphat is given, night and morning, two days before the operation followed by bromides. The author disinfects the skin in the operative field with tinctur of iodin, and advocates the temporary paralysis of lid by novocain injection. The lid margins are massaged with iodin. The lacrimal passages should be irrigated with sterile water, and in doubtful cases an astringent collyrium and irrigation of the lids with half a liter of sterilized water. The author has had more than 200 operations since 1919 without panophthalmitis.

Wright advocates the preliminary blocking of the facial nerve before cataract operations. He uses a 2% novocain injected five minutes before operation. The needle is entered over the center of the zygoma and following the latter is pushed toward the pinna. Infiltration is effected as the needle is withdrawn. The needle is then turned and pushed to a point approximately below the center of the eye. The author reports that 100 "squeezers" were successfully dealt with in this manner. It does not complicate after treatment in any way, and has no adverse effect on the patient. He supports the principle of temporary paralysis as advocated by Van Lint and Villard.

Imre advocates the control of the conjunctival flora, serum bouillon method. Disinfection during 2-3 days before operation by daily washings with boric acid solution and instillations of 1% ethylhydrocuprein hydrochlorid and 2-3% collargol.

Blaskovics produces immobilization thru his safety speculum and his superior tendon check suture. The closure of the wound is by Kuhnt's plastic conjunctival covering. The section comprises 2/5 of the corneal margin. He makes a small iridectomy with a radially placed scissors. A broad opening of the capsule is made with a modified forceps, the grasping branches having the curving of the lens. To remove the remnants of the lens, he irrigates the anterior chamber with his irrigator. Visual results, at least 0.7, frequently 1.0. Gaping of the wound once, as contrasted with a previous 8%.

Thompson and **Thompson** insist upon a careful study of the patient before operation, and believe that success depends upon physical fitness of the patient as much as perfected detail of the technic. They advocate the administration of bicarbonat of soda for a number of days immediately preceding the operation. Measures are taken to develop the confidence and cooperation of the patient. Operating in the patient's room is preferred to the operating table. The old operation is preferred to the intracapsular, owing to the high percentage of vitreous loss and other accidents which in their judgment is unavoidable in the Smith technic.

Fixation of the tendon of the superior muscle after the method of Blaskovics is chosen by **Imre.** A broad conjunctival flap and total iridectomy are advocated with capsulotomy by means of Schulek's forceps. The author finds Smith's method unsatisfactory, and to be adopted only in suitable cases. He believes that intracapsulotomy can be done by either grasping a broad fold with the forceps and the lens freed from its zonula by gentle rotation, or after iridectomy the conjunctival flap is held open by an assistant, and by means of slight pressure on the cornea, the lens is delivered, the remaining zonular fibers being separated in the region of the coloboma by a small spatula. The danger of vitreous prolapse is thus lessened.

SPECIAL OPERATIONS.—**Rubbrecht** performs external *canthotomy* and controls the lid margins by means of a wire loop in the middle of the border of the upper lid, and another in the middle of the border of the lower lid, which are held by the assistant.

Ellett advocates the *corneal suture* because: (1) It reduces the likelihood of vitreous loss, (2) it permits simple extractions with a smaller percentage of iris prolapse, (3) promotes early closure of the wound and permits patient to get out of bed sooner, and (4) it enables the operator to make a more thoro and preparatory toilet of the wound. The author minimizes the general objections. The method used is that advocated by Kalt, and this paper reports on its use in 249 cases. Vitreous was lost in 18, prolapse of iris in 24. Simple extraction done in 223 cases; 32 cases were extracted in capsule.

Iribarren quotes his personal experience in 300 cases with which a corneal suture was employed. He expresses his satisfaction with a procedure which avoids many serious postoperative accidents. **Basterra** advises use of the corneal suture in cases with fluid vitreous, high myopia, luxation of the lens, increased intraocular tension, and in patients suffering from chronic bronchitis or emphysema, or likely to be difficult to control. Otherwise he advises against the suture.

Elschnig recommends for extraction of atypical forms of cataract such as dislocated lenses, myopia and exophthalmus, the formation of a *bridgelike conjunctival flap*. For cataracts with no or very shallow anterior chamber, incision with keratome is recommended. The author describes the procedure of cataract extraction within the capsule, and reports his own experience with Col. Smith's method.

Ridley describes a new *cataract knife*, which is 33 mm. in length and 3 mm. wide at the base. The back of the blade is straight, stiff and in line with the handle. A knife of this design prevents loss of aqueous.

Verwey mentions the results of his experiments in attempting to remove the lenses of a pig's eye by *suction*. He considers the expression, "extraction of cataract," incorrect; as the forceps is not yet made, which can extract the opaque lens.

Meyer makes a plea for the preservation of the round pupil. He advocates a *peripheral iridectomy* according to the Hess procedure, as an operation which combines the advantage of simple and combined extraction and has the disadvantage of neither.

The following *suture* is advocated by **Frisch** as a method of preventing loss of vitreous. White silk spool thread, size B and 25 cm. long, on a small curved needle, is used. A loop like a single bow knot is tied 10 cm. from one end and drawn out so that a loop remains only 1 mm. long. The needle is inserted into the cornea 1.5 mm. to the temporal side and 2.5 mm. below the upper corneal margin, emerging about 1.2 mm. above insertion, without entering the anterior chamber, and the thread pulled thru until the knot is in contact with the cornea. The needle is then carried to a point 4 mm. above the limbus, emerging 1.5 mm. above that. The thread is placed in such a way as not to interfere with the corneal section. At any time during the operation, the wound can be closed rapidly by pulling in any direction, the long end of the thread. If the operation has progressed without incident and the operator is ready to tie the suture, the knot can be eliminated by pulling on the short end.

Santos Fernandez writes that the critical point in a cataract operation is *capsulotomy*, since many extractions fail because of resulting inflammation. The method of the late Dr. Herman Knapp appeals to the author as being the one to best avoid secondary membranes.

Knapp believes that the method of treating the capsule depends upon two factors: the patient and the kind of cataract. He thinks the cystitome is the most readily manipulated instrument and is, therefore, the one of choice for less experienced hands and in cases of badly behaving patients. He advocates a peripheric linear incision as was advocated by Dr. Herman

Knapp, as being the one most likely to give good results. The toothed capsule forceps is more difficult to handle than the cystitome. In using it, great care should be taken to avoid inclusion of capsule in the corneal scar. Secondary glaucoma also results from the torn margin of the anterior capsule becoming adherent to the posterior. A case in point is quoted.

The author prefers the blunt forceps devised by Kalt, and speaks of the technic of its use, particularly as a means of dislocating the lens. He points out that the more hypermature the cataract, the easier its dislocation. It is not likely to occur in patients under 50, altho the amber, sclerosed lenses dislocate easily. After discussing his method of extraction after dislocation, as suggested by himself and Török, he concludes his contribution by suggesting the value of a combination of the two methods.

Greenwood reports 25 cases of *intracapsular extraction* by means of Verhoeff forceps. One half per cent atropin is instilled along with the first drop of cocain. After anesthesia a general conjunctival flap is fashioned and iridectomy is done. A suture is frequently passed thru the conjunctival flap at this point. After a medium sized full iridectomy by means of the Verhoeff forceps, the capsule is grasped about at its middle, if anything a trifle above the center. A gentle motion is then made from side to side, and the capsule forceps then drawn straight upward. As the forceps begin to emerge from the eye they are pulled slightly forward) and tilted forward. The suture is then tied, if one has been introduced, and the pillars of the iris replaced. Out of the 25 cases reported, 21 were extracted in the capsule. He advocates this method in immatures, posterior polars and Morgagnian cataracts.

King believes that many features of the Smith technic can be incorporated into the old operation with striking advantages, such as the method of Smith's incision, replacement of the iris after iridectomy and the use of strabismus hook and spatula in intracapsular extraction.

Pratt and **Pratt** report on 50 cases of cataract operations according to the Smith-Indian-Fisher method. The Fisher needle was used in six cases. In three of these subsequent needling of the capsule was necessary. The capsule ruptured in three cases, iris prolapse in four, and vitreous loss in seven.

Espino reports one case of intracapsular extraction according to Col. Smith's method, with complete restoration of vision. He has used the Barraquer method in over 600 cases successfully. He believes these two methods an improvement on the older methods. **Mixra** has written on the modified Smith intracapsular extraction.

According to **Stanka**, the value of incision of the root of the iris is arrived at from the frequency of *prolapses of the iris*. Out of 1896 cataract extractions, from March 1911 to July 1920, 1373 were performed by Prof. Elschnig with 20 (1.4%) prolapses of the iris; 14 in the first 24 hours after the operation, 6 later. Fourteen of these were replaced with preservation of a round pupil, i. e. 0.4% had no coloboma. Out of the 523 extractions done by assistants, 19 had prolapses (14 early, 5 late), 11 were replaced and 8 cut off. Indications for combined extraction of uncomplicated cataracts were old age, over 80, unruly behavior, adiposity, exophthalmus, severe aomalies of metabolism. The incision of the root of the iris is technically more simple and less painful than Pflüger's basal excision.

Turk reports 100 operations of senile cataract with *keratome*. He uses the ordinary broad keratome, recommending a long incision, not less than half the circumference of the cornea. A *conjunctival flap* is formed by pushing the conjunctiva ahead of the keratome point. The instrument is inserted into the anterior chamber until its point almost touches the lower angle. The incision is then enlarged on either side with scissors. The author claims a simple technic, better wound closing, more prompt regeneration of the anterior chamber, less wound reaction and less astigmatism. He recommends the conjunctival flap as an important protective measure.

Hensen finds that the use of the keratome for cataract operation is preferable to the von Graefe knife and flap incision. He believes that the technic is very much simpler, and the operation can be performed without danger by the less experienced operator.

Gifford points out that for the cataract extraction no one point of fixation can be equally good, both for the puncture and the cut. The difficulty of achieving accuracy in the puncture and counterpuncture is so much greater than in finishing the cut that the operator advises firm grasp on the inferior rectus tendon. Gifford advocates the instillation of 10% solution of cocain, or the injection of a drop of 2 or 4%.

In operations for total extraction of senile cataract, **Barraquer** relies on the vacuum cup which is equally useful in breaking the zonula fibers and extracting the lens. The author lays more stress on the rapidity than intensity of the vibrations. All zonulas and capsules not being of the same elasticity, the force of the vacuum created should be in direct ratio to the fragility of the zonula, which may be estimated beforehand, by careful examination with the binocular microscope and Gullstrand lamp.

The author's technic is as follows: 1. Preparatory pupillary dilatation to the greatest possible degree by the use of euphthalmin and cocain. The upper lid is controlled by a Desmarres elevator and the eye directed downward. An incision, occupying two-fifths of the circumference of the cornea, is made with a Graefe knife, finishing with a general conjunctival flap with a long tongue. (2) A small opening is made in the iris according to Hess' technic. (3) The vacuum cup is introduced later into the anterior chamber, passing underneath the iris and advanced to the lens surface. A vacuum is then created. With a gentle rotary manipulation, the zonular fibers are ruptured, the lens is turned and the lower border delivered first. The eyeball is not fixed during the operation.

Barraquer prefers a diffuse lighted room, with oblique illumination in the operating field. Two hours before the operation, the lids are bathed in a 4/100 solution of silver nitrat, neutralized with sodium chlorid, the lashes are then rubbed with biniodized oil. The author advocates a temporary orbicularis paralysis. Both eyes are bandaged, the unoperated eye being uncovered on the third or fourth day. The reader is urged to consult the original articles appearing in various journals for the complete details in the technic of Barraquer's procedure. All of these articles are profusely and carefully illustrated.

Gallemaerts reports 24 cases of extractions according to the method of Barraquer, without a single loss of vitreous. Detailed case reports are appended. **Green** and **Pacheco Luna** visited Prof. Barraquer's clinic, where they examined cases before and after operation, some of whom had been operated on 3 or 4 years previously. The authors conclude that this method, with slight modifications, will probably become the operation of the future for all intracapsular operations, as it appears to be the safest.

Smith expresses the wish to assist in any movement toward the development of the intracapsular extraction and suggests that the Barraquer instrument might be improved by changing the hand control of the valve for foot control. He believes that the Barraquer instrument should grip the front of the lens, and then be rolled between the fingers to break the zonula in much the same manner as in his own operation. He warns against the creation of a temporary vacuum behind the lens, if the lens is lifted forward from the vitreous body.

Knüsel and **St. Martin** discuss and describe the method of Barraquer. After discussing the advantages of Prof. Barraquer's operation, **Van Duyse** appends the history of suction method.

He finds that in the year 100, Amar removed a cataract by the suction method. The Arabs also used this method in the 11th century. It is mentioned by Guy de Chauliac in the 15th. century. It was reintroduced in the 19th. century by Blanchet in 1846, for soft cataracts. He does not consider the vibrator vacuum used by Barraquer is necessary for the success of the method. Desiring a simpler Barraquer apparatus, **Munoz Urra** creates a vacuum by placing a cylinder in hot water; immediately afterward the cylinder is immersed in cold water. This produces a vacuum which is controlled by a valve. This apparatus has been used in a number of extractions after the method of Barraquer, producing satisfactory results.

Likewise **Marbaix** produced a vacuum receptacle with an indicating scale in order to find the exact intensity of the vacuum. He also finds that a vibrator vacuum is not necessary, and reports three cases extracted by this method. He believes, that when done with caution, the method is superior to others.

In a discussion of the relative merits of the two leading methods of dealing with cataract, **Smith** concludes that intracapsular extraction is only within the range of men who have had high class technical training in the art. He speaks of it as a difficult operation, as compared to the capsulotomy. The intracapsular operation requires a skilled assistant. He prefers the intracapsular operation, because there is no secondary membrane to deal with; iritis is practically absent, and better vision is claimed for intracapsular operation. The author states that vitreous escape in skilled hands is the same in both operations, but he believes that sepsis more frequently follows capsulotomy. Speaking of Barraquer's operation, he considers the suction operation somewhat complicated. In answering the criticism, that what will satisfy the Indian will not satisfy the white races, he calls attention to the fact that the Indians belong to the same Aryan stock as Europeans, and he thinks they are not as good subjects for operation as Europeans.

McDannald's instrument for extraction by the vacuum method consists of a hollow metal handle to which is attached a tapered silver canula 3 cm. long, the smallest outside diameter of which equals 1 1/2 mm. One cm. from the end, the canula is bent as an angle of approximately ten degrees: the end is flared out, and in this broadened end is fashioned an oval suction cup, 2 1/2 mm. in width by 3 mm. in length and 1/2 mm. in depth. The entire instrument is 12 cm. long. Four cm. from the end of the suction tip, a 4 mm. opening is made in the large tube or handle. The hole is situated where it can easily be closed with the finger.

The handle of the instrument is inserted into the open end of a rubber connection tube, which is attached to a rarefication pump. The amount of vacuum is regulated by a vacuum control gauge, which should be set from 10 to 15 pounds. The author believes that the intracapsular extraction should be limited to sclerosed lenses, hypermature lenses in which the capsule is thickened. Patients over 60 years of age, lend themselves very well to this procedure. Preliminary iridectomy is performed when possible. A wide corneal incision is found to be necessary. Atropin is used after extraction. McDannald thinks that the method possesses very satisfactory possibilities when employed in properly selected cases.

Green and **Green** suggest some modification of the Barraquer apparatus by way of a floor valve, which is controlled by the foot; an air vent in the canula, and a round instead of an oval cup. The authors believe it is advisable to limit the intracapsular operation to patients over 60, excluding Morgagnian cataract. Patients with deep set eyes and lax lids afford the greatest safety. The more prominent the eyeball, the greater the danger. The authors' method of procedure is as follows: After proper general preparation, atropin is instilled one hour before operation. An incision embracing half the cornea is made. The vacuum apparatus is applied to the lens, which is dislocated by gently rolling the canula between the thumb and index finger, so that the upper border of the cataract is tilted forward into the wound, and the delivery assisted by gentle pressure with curved iris forceps to the lower part of the eye near the limbus.

Ormond having observed in certain types of cataract the lens readily becomes dislocated in process of a free cystomy, had a cup made for extraction, resembling a large meibomian scoop with a hollow handle, attached to a vacuum by means of a tube. Such a vacuum may be produced by a water filter pump of University type. The author advocates a large corneal incision and prefers iridectomy. **Maynard** described Barraquer's technic and instruments and quotes statistics. He is of the opinion that the procedure is a distinct step forward.

After Treatment. — Once more **Snyder** reiterates the importance of careful history and physical examination in all cases that are about to undergo cataract operation. He goes carefully into detail of individual handling and watchfulness, both before and after the operation. **Miller** notes that many failures in eye operations, especially those done under local anesthetics can be traced to improper environment, poor assistants and faulty operating room technic.

Millette believes the best treatment for cataract operation is that which interferes least with the patient's physical and mental activity. Greater freedom of action is granted than is frequently allowed. The patient's body is turned towards the side of the unoperated eye the morning following the operation, and use of the unoperated eye is given. On the second morning following the operation, almost complete freedom is given. Bandage over the operated eye is soon changed to loose pads, then to dark glasses and brow shade, which measures tend to avoid or abort infection.

Complications.—In a case of fluid vitreous, complicated by cataract, **Koch** did a combined operation up to a completion of the capsulotomy. The lens could not be tilted, and extraction was defeated because of the presentation of thin vitreous. The operation was discontinued; and the eye healed and remained quiet with good light perception and projection.

Allport operated on a woman of 60, who had suffered recurring attacks of choroiditis, iritis and floating opacities. A preliminary iridectomy and attempted extraction had been performed by another operator. Fisher's retractors were used instead of a speculum. Upon completion of the incision, the eyeball began to collapse and the lens sink into the vitreous chamber. The loop was quickly introduced. The lens was delivered and the eye irrigated with normal salt solution. No dressing was attempted for six days. Healing was uneventful. The second eye was operated on one month later, with much the same experience. Visual results were 20/40 in each eye. Allport attributes the success to: operating in bed, use of retractors instead of speculum, a quiet patient, the prompt use of loops and use of salt solution to fill the collapsing globe.

Atony, or lack of resistance and elasticity of the external ocular membranes, may be the cause, according to **Marquez**, of the ocular crumpling and depression. This explanation does not seem as probable as that offered by the theory of a passing inhibition of the sympathetic system, the ocular paralysis of which is the cause of hypotony. The collapse of the globe during operation bears some similarity to ophthalmomalacia, characterized by transitory crises and relapses of marked softness of the eye, in the etiology of which certain paralytic alterations of the sympathetic system intervene.

Butler warns that the loss of vitreous in cataract extraction is a serious complication, and notes that the average percentage of vitreous loss is about six. The causes given are: (a) lack of dexterity on the part of the operator, (b) abnormal conditions of the eye and bad behavior of the patient.

Vitreous loss may be minimized by preoperative treatment which includes the psychic phase. He believes that the best results are obtained from what he chooses to call a suitable ophthalmic atmosphere, proper nursing and surroundings. In obviously nervous cases, the author prefers general anesthesia, and believes the substitution of retractors does not insure against vitreous loss, in fact thinks they do more harm than good. He urges preliminary iridectomy in suspicious cases; and in the event of prolapse of vitreous, lids are closed at once and the eyes bandaged.

Thompson reports further on a case of cataract complicated by congenital coloboma of the iris. Extraction had been undertaken on the left eye; the corneal incision was made downward, the incision enlarged with de Wecker scissors, and iridectomy done at the upper central part of the pupil. After capsulotomy the lens refused to present. A strong fibrous band was found connecting the lower borders of the iris. The lens was delivered after severing this band. A needling had been done and vision was fingers at 10 feet. Dr. Finnoff in discussion thought the fibrous band was a continuation of the scleral portion of the mesoderm, which normally intruded itself thru the choroidal cleft.

Fergus performed a cataract operation on a man well over 70 years, without untoward accidents. The next day, the patient developed a severe pain in the gastric region followed by vomiting and hematemesis. **Nagle** reports cataract extractions complicated by a cyst of iris, early localized infection of the cornea, which yielded to treatment, severe iridocyclitis following needling, and diabetes resulting in infection and removal of each eye.

Arana's patient was 76 years old and gave a history of ocular disease of 15 years duration. The pupil was large and, altho black, gave an iridescent reflection upon lateral illumination. Pupillary reaction was normal and there was good light projection. Despite a large corneal incision and iridectomy, the lens was delivered with difficulty. The patient made an uneventful recovery, with good corrected vision resulting. The author discusses the theory of pathogenesis of black cataract and its chemical composition.

Rollet and **Bussy** observed that black cataract occurs in elderly subjects and develops with great slowness. Its operative outlook is more serious then in the senile type. The cataract is characterized by extreme density of the crystalline fibers, and the dark color is due to the presence of tryosin oxid. **Takeishi** also writes on black cataract.

Killick cites the case of a 63 year old woman, one of whose eyes had been enucleated because of typical changes following a serous iritis. Meantime the remaining eye developed iritis, which resulted in iris bombé and increased tension. An iridectomy afforded some improvement. Subsequently the pupillary area became covered with pigment and inflammatory exudate. Another iridectomy was successfully performed with 6/18 vision, which persisted one year, but occlusion eventually occurred. Twelve years later, this patient was seen with a black opaque lens, which was extracted. After a somewhat prolonged convalescence, in which there was a stormy iritis with hemorrhage, vision of 5/60 remained. The author believes that her case suggests that pigment came from the uveal tract. Tyrosin was demonstrated when the removed lens was hydrolysed.

Santos Fernandez believes that patients suffering from prostatic disease make a poor recovery from cataract operation; because their rest is disturbed by frequent micturition and other disturbances incident to the disease. Two cases are reported. The author advises correction of any prostatic trouble before undertaking operation for cataract.

Meller notes that altho increase of *intraocular tension* is not frequent, it is a very important complication in extraction of cataract. When it does occur, it is usually a symptom of other morbid processes such as iridocyclitis. It may also be caused by adhesion of the iris to the wound, and adhesion of vitreous is not rare. Capsule and lenticular remnants are quoted as causes. All these forms of glaucoma are secondary, and their cause easily discovered. Sometimes, however, glaucoma supervenes without a discoverable cause. The acute form is rare, but the chronic form quite frequent. The author notes that the cases of increased pressure after extraction were more frequent in cases in which there was delayed formation of the anterior chamber.

Stieren reports three cases of acute *glaucoma* following successfully performed combined extractions, in one case the attack developing after ten years, in the second eighteen months, and in the third, four months. One of these cases was subject to trephine operation, at which time viscid fluid escaped thru the wound; which leads to the suggestion that blocking of the filtration angle was due to a change in the vitreous causing occlusion of the spaces of Fontana.

Gifford believes that the only justifiable procedure in the event of loss of vitreous is to discontinue the operation and to rely upon subsequent measures to restore vision. He suggests that there are three courses open if the first operation has been interrupted: 1. Neglect the cataract until the second eye has been operated on. 2. Absorption by repeated discissions. 3. Prepare for loss of vitreous by dissecting up a large flap, to complete removal of lens by loop or hook after the ordinary incision. He quotes cases ranging from 34 to 67 in which discission was successfully performed. He closes a very valuable article by saying that in any given cases the operator can hardly go wrong if he adopt the plan which he would want followed if he were on the table instead of at its head.

Tuttle's 74 year old patient spontaneously expressed her own lens after the completion of the corneal incision. Despite subsequent slight prolapse of vitreous, satisfactory distance and near vision was obtained.

Kayser finds that external *blepharotomy* preceding cataract is harmless and renders the operation much easier. By preventing tension of the lids, vitreous prolapse is lessened. He prefers the capsule forceps to the cystitome. In 11.2% of his last 150 cases, operation was complicated by increased intraocular tension. He believes that all cases developing glaucoma after operation have a predisposition to increased tension. Cataract operation improves the preoperative cases of glaucoma. While atropin is very valuable in the after treatment of cataract in the prevention of iritis, there is danger of its increasing intraocular tension. In two of the author's cases, he believes that it did no harm. In three-quarters of the cases reported, vision was 6/9 or better, and in more than 40% normal vision was attained.

Basing his work on that of Bailliart, **Salvati** examined 45 subjects having cataract, in order to determine the general arterial tension as compared with the intraocular tension, by means of the tonometric oscillations. Observations on the ocular tension were made before the operation and one month after the operation. He has shown that there exists a constant relationship between general arterial tension and local arterial tension of the eye; and there is, up to a certain point, dissociation between the general arterial tension and the ocular tension, and extraction of the lens does not modify the tension of the globe. He believes that one may, by a study of the movements of the tonometric needle, get precise information on the state of tension of the vessels of the eye. Such a procedure may permit the combatting of one of the factors capable of occasioning expulsive hemorrhage.

Shanker likens the normal eyeball to a rigid box. The elastic forces which antagonize in natural condition, are disrupted in cataract operation. The lens diaphragm is destroyed, especially in intracapsular operation. Preventive measures consist in keeping the orbital fat cushion in its proper place and taking away the tension and compression of external muscles from the softened eyeball. This can be accomplished, in part, by drawing away the lids. Prominent eyeballs are more exposed to pressure than sunken ones. He believes that vitreous frequently escapes at operation without either the operator or patient being at fault, but he believes that extra precaution should be taken in the cases of prominent globes.

SEQUELS.—**Morax** states that infections may develop immediately or late after cataract extractions, despite proper precautions. He regards pain, which persists and is exaggerated after the first twelve hours, as a cardinal symptom of infection. A study of the statistics reveals that pneumococcus is by far the predominating infection agent. The conditions favor organisms on the lid margins or in conjunctiva, ulcerated blepharitis, infected tear passages. The latter condition is best handled by thoro extirpation of the lacrimal sac or closure of the puncta by cautery. He comments upon the efficiency of oxycyanid 1/6000 irrigation. Among the complications which favor infection, Morax mentions entanglement into the wound of epithelial tissue, iris, fragments of lens or its capsule. The author believes that extreme care should be taken in the toilet of the cataract wound.

In **Würdemann's** case, one eye was operated on by the intracapsular method, resulting in satisfactory corrected vision. Two years later, the other eye was operated upon and the patient discharged from the hospital after a normal convalescence. Two months later, iridocyclitis developed in the last operated eye, at which time the causal factor appeared to be abscessed molars, which were extracted. Two months later she appeared at the clinic with a stormy iridocyclitis in the first operated eye, which went on to blindness, despite thoro treatment. Würdemann believes that the infection of the second was endogenous from the apical abscesses of the teeth, and believes that the removal of the teeth permitted the infection to get into the general circulation, attacking the previously sound eye.

A patient, suffering with cataract was unable to distinguish light but nevertheless was operated upon by **Santos Fernandez**. The ophthalmic examination revealed no discoverable changes. Some days after the operation, the patient was able to walk alone. The only explanation of this remarkable case seems to be that the patient had cataracts so long that he made no effort to see.

Chance exhibited a case of distension of the ciliary segment of the globe in a young man who had had bilateral cataracts extracted two years before. When discharged there was nothing abnormal in either eye. Now he returns with impaired sight in his left eye and swelling of the globe in the anterior segment, extending some distance below the external angle of the extraction cicatrix, which was well within the cornea and seemed to be free of iris tissue. The ciliary disturbance was thought to be due to inclusion of the lacerated tissues during the healing of the wound, after extraction of the lens.

GENERAL PAPERS.—**Sattler** concludes that of the many schemes and suggestions pertaining to the *medical treatment* of cataract, it can be stated that all have been proved absolutely barren of conclusive results. Every case of senile cataract with commonly accepted surgical risks, is operable. The question of immediate or deferred operation is decided upon by the degree of helplessness or the ocular infirmity of an individual. The author believes that if the intracapsular operation is contemplated, that of Smith should receive the first consideration, as being the safest and less complicated in technical execution.

Veasey obtains the best results by combined extraction, preferably after a preliminary iridectomy. He prefers capsulotomy and usually irrigates the anterior chamber to remove all possible debris. The first dressing is made at the end of 24 hours and atropin instilled. The patient is under observation for some time prior to operation and a course of alterative treatment is recommended on the grounds that cataract is a result, to some extent, of malnutrition.

Higgins prefers the combined extraction with preliminary iridectomy, and lays stress upon the necessity of general preparation for the success of the operation. All infections, particularly dacryocystitis, must be excluded. He prefers a member of the family, if possible, as a nurse.

Ganguly warns against the offhand diagnosis of cataract and insists upon dark room examination before the expression of a diagnostic opinion.

Welton believes that, in addition to the usual physical examination, teeth, mouth and nose should be examined for sources of infection, and thinks thoro dental prophylaxis should precede cataract operation. The author insists upon operation at a hospital, and uses scopolamin and morphin before the operation. He prefers a hook for the upper lid and uses a large corneal section.

Campbell prefers Hess' retractors and advocates the use of atropin one or two hours before operation as minimizing the risk of wounds of the iris. Extraction is performed before iridectomy, even if the latter is contemplated, unless the pupil fails to dilate. Campbell prefers a basal iridectomy because it prevents the capsule becoming entangled in the wound.

Fisher writes in a general way concerning cataract operations as to the selection of cases, sterilization of instruments, training of assistants and choice of anesthetics. The author has discarded the speculum in favor of lid hooks of his own design. He advocates a small iridectomy and believes that the cystitome and capsule forceps are inadvisable, in that they may dislocate the lens and their use prevent removal of the lens in the capsule. Three days after operation, fresh dressings are applied, but the lids are not opened until the ninth day under ordinary circumstances. He believes the use of atropin should be discouraged except in complicated cases. His own needle is used to prevent loss of vitreous, when the lens refuses to be born after safe pressure has been made. Fisher recommends the use of kittens' eyes, in preference to pigs' eyes, for experimental work.

In his communication, **Ellett** agrees that operation should be undertaken as soon as the patient has an embarrassing failure of vision. He believes that complete anesthesia, quiet in the operating room, relaxation of the patient, large corneal incision, free capsulotomy, and careful toilet of the wound, all make for safety in operating. He reiterates his preference for the Kalt stitch.

Hirschberg, realizing that different vocations require different demands on vision, feels that these considerations should be weighed in advising early operation. He feels that it is advisable to extract immature cataracts in artists, sculptors and scientists, because such patients do not desire to wait until cataracts are mature.

Potter describes, in general, the indications for cataract extraction and the choice of methods. He believes that, undoubtedly, circumstances should be the guiding factor, and is not convinced of the advantage of the intracapsular method. The aim of the surgeon should be to give the patient the best visual results thru the operation which is best suited to the individual operator. **McReynolds** and **Fox** write of the visits of Col. Smith to their centers.

After Cataract.—After a discussion of the difficulties of dealing with secondary cataract, **Gourfein** quotes statistics showing the percentage which fail in various operators' hands. Gourfein describes an instrument, which he has devised, which has the general form of the Bowman's needle when it is closed and cutting needle when open. It is introduced closed, and opened by pressure on a button located on the handle. Four illustrations accompany the article. **Ellett** reports a case of dense secondary cataract following a simple extraction in which there was considerable reaction.

Duverger believes that a narrow von Graefe knife, when used with good technic, obviates all difficulties associated with other methods of dealing with secondary cataract. The knife enters the cornea 2 mm. in front of the limbus at the superior extremity of the vertical diameter, the point transfixes the membrane below the posterior border of the pupil, and the operation is continued with a sawing movement of the knife edge. The section terminates either at the upper edge of the pupil or 2 mm. from the limbus depending upon whether or not an iridectomy had been done. The result is a vertical slit which is enlarged by the pressure of the vitreous and the natural reaction of the membrane. The author prefers a vertical slit, altho the section can be made in any other diameter. He uses a von Graefe knife for iridocapsulotomy. No case of infection has followed the operation. Excellent results are reported on 30 patients, operated upon according to this method.

Secondary cataract in the Heidelberg Clinic is the subject of a thesis by **Berus.**

Walker presented a patient, 55 years old, upon whose eye a capsulotomy had been successfully performed 33 years after injury by a piece of wire. The resulting correcting vision was 20/200. **Walker** also presented a 61 year old patient in whom, 16 years after cataract extraction, complete spontaneous rupture of the posterior capsule of the lens was found to have occurred. Vision, at the time of the report, was light perception.

For after cataract patients with the pupillary margin tied down to the membrane, **Smith** advocates a special technic. The cases are heavily atropinized before operation. A liberal sized iridectomy incision is made in the sclerocornea. An iridectomy is performed if one has not already been done. A small curved dissector is inserted into the posterior chamber and iris separated from the after cataract. A good iris forceps is inserted below the equator, with points widely separated and then pressed together into after cataract, and the whole membrane extracted. The results are eminently satisfactory in this type, that otherwise resists operative attack.

Statistics and Results.—In reporting the results of Col. Smith's visit to the Illinois Charitable Eye and Ear Infirmary, **Findlay,** states that all of the cases that were presented for operation had good light projection with clean laboratory records. Preparation and after treatment followed as closely as possible the directions given by Col. Smith. The intracapsular extraction was performed in all cases except one. where the capsule ruptured before delivery. In one case only was there loss of vitreous, and that in a squeezer. Four of the cases resulted in total failures: Case 1, from vomiting; case 2, patient squeezed during operation with loss of vitreous, followed by severe iridocyclitis with iris drawn up and pupil occluded. Case 3. Patient tore off bandages on the third day. Severe iridocyclitis followed. Case 4. Iridocyclitis.

Good results 20/30 or better	33.3%
Fair results 20/40 to 20/50	26.6%
Vision of 20/65	13.3%
Failure	26.6%

In summing up from such a limited number of cases, the results did not show an improvement in visual result over capsular operations. The inflammatory reaction was as great if not greater. The cosmetic results were unsatisfactory owing to a large iridectomy.

Fisher reported that at the Chicago Eye and Ear Hospital, Col. Smith performed 16 intracapsular cataract operations on 15 patients. Visual results quoted: Nine had 20/20 or better; two had 20/25; one had 20/30; one had 20/40; one had 20/50; one had 20/60, and two had no vision. Ten were uncomplicated, one had vitreous loss, one had iritis and one had choroidal hemorrhage on the table.

Zentmayer summarizes the results obtained on the cases operated at Wills Hospital by Col. Smith in tabulated form:

6/6	2 cases.
6/9	2 cases.
6/12	2 cases.
6/15	3 cases.
6/20	4 cases.
6/30	2 cases.
L.P.	2 cases.

Not recorded, 1 case.
Vitreous loss, 38%.

Incarceration of iris, including 2 cases of prolapse, 38%.

Secondary glaucoma occurred once.

In 2 cases abscission of the iris was necessary.

In one case iridotomy was necessary.

In most of the cases, there remained either vitreous haze or definite vitreous opacities.

Knapp reports the second hundred successive extractions of cataract in the capsule after preliminary subluxation with the capsule forceps. The technic has not changed from that related in the first 100 cases, the method being applicable in suitable cataracts and in tractable patients. There were 18 hypermature, 38 mature, and 44 immature cataracts, 78 uncomplicated, and 22 complicated cases. Subluxation succeeded in 50% of the cases, the same as in first series. Visual results were good, and no instance has been found in which the eye has suffered any late deterioration or change. The author is convinced that extraction in the capsule should be the goal, and that subluxation by any procedure, except by external pressure, should be adopted.

Parker states the results from private operations and those from the ophthalmic clinic of the University of Michigan for the past 16 years. Of the 1,421 operations, 1,013 were combined extraction; 156, simple extraction; 49, Knapp's operation; 91, Indian operation; 8, trephine operation for glaucoma, and 104, preliminary iridectomy. In the Indian operation there was a higher percentage of loss of vitreous and of failures due to accident and postoperative complications than was shown in any of the other methods. In the combined operation, there was the least percentage of failure due to accident and postoperative complications, while in the simple operation there was the smallest number of cases of vitreous prolapse.

These percentages refer only to cases recorded as having visual acuity less than 6/60. Cataract delirium occurred in 2.3% of cases, 33% of these having a history of alcoholic excesses. Detachment of the retina was noted in six cases but in all spontaneous reattachment took place. The author concludes the combined operation with a conjunctival flap is probably the most satisfactory method of procedure in all but especially selected cases.

Prolapse in simple extraction is more than twice as frequent, without the use of atropin before operation. Simple extraction was performed in young patients and selected senile cases with large cornea and well dilated iris. When simple extraction was done, the eye was examined the day after operation, and if prolapse was present an iridectomy was done. The traction method of extraction of Knapp and Török is the best for extracting the lens in its capsule. The secondary operation after the Ziegler method, was performed more than 200 times with no serious reaction following. Preliminary iridectomy was performed in cases with equally developing cataracts in both eyes, and also in cases with fluid vitreous and in all cases suggestive of glaucoma.

The result of a compilation of statistics of cataract by **Cuéllar** and **Pava** from May 1, 1916, to Feb. 29, 1920, of the Santa Lucia Clinic are as follows: 1. The positive results in operation for congenital cataract were 100%. 2. Juvenile cataract is most frequent in Colombia in women; most frequent in hot countries; most frequent in the right eye; the operation in greatest use is the simple extraction, and all cases have given satisfactory results. 3. Senile cataract occurs more frequently in women than in men, and more often in the right eye; the majority of patients come from warm regions; in most of the cases combined extraction was done, and out of 94 cases operated, 92 or 97.9% were successful. 4. Cataracts due to sudden detachment of the retina are relatively frequent; they occur as often in men as in women; as far as vision is concerned, they are operative failures. 5. Cataracts following iridocyclitis are more frequent in men than women, which is natural, as men are more exposed to traumatism. According to the Santa Lucia statistics eight cataracts following iridocyclitis are of traumatic origin, i. e., 72.7%; intervention gives 72.8% successful cases, mostly all of which are the traumatic cataracts, meaning almost 100%. 6. Postoperative opacities of the posterior crystalloid are not rare, and its extraction gives good results. 7. Glaucomatous cataract is frequent in Colombia, since out of ten cases of chronic glaucoma listed, there are three cataracts; the only result obtained by operation is lowering of the tension, but no improvement of vision.

Grosz writes that during the past 17 years with the Royal Hungarian Hospital at Budapest, he has personally performed 5,400 cataract extractions. He attaches great importance to the sterilization of the conjunctiva, which he accomplishes by the use of 10% of argyrol solution and flushing with 1-10,000 oxycyanid of mercury. A 1% solution of ethylhydrocuprein hydrochlorid is added when the bacterologic examination shows the presence of pneumococci. Fixation of the eye, which is accomplished by Weber forceps, is intrusted an assistant, or Angelucci's method is employed in restless cases. A large corneal wound is made with a generous conjunctival flap. Combined extraction is done in preference to the Hess method or Elschnig's incision. Extraction within the capsule is done in from 10 to 20% of cases and Schulek capsulotomy is preferred. Vitreous prolapses are reported as occurring from 2.5 to 3%. The number of postoperative inflammations is about 2.5%. Complete failure about 1%. Reopening of the wound occurs in 8%, which in the judgment of the author is largely due to the lack of discipline on the part of the patient.

Holland reports 2,412 operations performed in a month, of which 1,203 were cataract, the highest in any one day being 112. Intracapsular extraction was employed in 95%. There were nine cases of sepsis and eight cases of choroidal hemorrhages. **Kraft** has written a thesis on the cataract operation in the Eye Clinic at Giessen from 1914 to 1919.

The Vitreous Humor

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This review covers the literature from June, 1921, to July, 1922. For previous literature see Ophthalmic Literature, 1921, v. 17, p. 215.

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DIGEST OF THE LITERATURE.

ANATOMY.—**Lewis** wrote on the anatomy of the vitreous, urging it as a highly organized tissue with a laminated structure.

EMBRYOLOGY.—**Monesi** studied the origin of the vitreous on embryonic rabbits. In his first series, in embryos of 6 mm. in length, the space between the secondary optic vesicle and the lenticular (crystalline) vesicle contained the hyaloid artery, besides protoplasmic trabeculæ, consisting of radiating fibrillæ. From the retina and the crystalline vesicle, they run toward the intermediary layer of the medial fibrillæ. This radial arrangement is intimately connected with the ectodermic cells of the retina and of the crystalline body, which in places present a conical appearance corresponding to the fibrillæ.

In his second series, embryos of 12 mm., the author could prove the presence of mesodermic cells having fine prolongations, which disappeared in the reticulum of the vitreous. The author states that the mesoderm takes part in the formation of the vitreous, while the participation of the ectoderm has not been proven. **Nordensen** wrote on the sources of the vitreous tumor.

ANOMALIES.—**Musy** described the appearance of an otherwise normal fundus, having a slightly waving nonvascular membrane, originating from the center of the papilla at the bifurcation of the retinal vessels, passing horizontally into the vitreous and almost completely hiding the macula.

Von der Heydt mentions that physiologic *hyaloid artery* remnants are found in a large percentage of normal eyes. A long spiral formed vessel remnant is found attached to the posterior capsule, somewhat nasally and downward from the lens center. This physiologic remnant hangs downward in the definitely discernible, optically empty posterior lental space, described by Berger. On motion of the eyeball, the lower free end of the spiral remnant is seen to gyrate freely.

Lewis presented a case of hyaloid remains, with the question whether a pigmented band extending from the disc attaching immediately back of the capsule of the lens was a vestigial hyaloid, or a definite tubular opening extending thru the vitreous. **Ganguly** described a case of persistent hyaloid canal. **Brazil** reports an abnormal hyaloid artery. It showed a delicate fan-shaped veil of fibrous tissue, springing from the disc and extending forward, upward and downward, one process reaching the posterior surface of the lens.

Sedwick presented a young woman whose right eye contained a blind but pulsating arterial stem, projecting forward about 3 diopters from the optic disc, making several spiral turns, and about equal in diameter to one of the primary branches of the retinal artery. This vessel was taken to be a persistent hyaloid artery.

Neame reported a case with branching remnants of persistent hyaloid vessels. He thought it likely that these processes arose from one common trunk. Vision in the right eye with correction was 6/36, in the left eye 6/9. Paton, in discussion, suggested that the condition might be one of proliferating retinitis, but Neame thought the five branches seemed to come so locally from the back, that this seemed to negative that idea.

VITREOUS HEMORRHAGE .— **Dimmer** reports two cases of red coloration of the vitreous of traumatic origin, in which the blood could be demonstrated with the ophthalmoscope, as the anterior chamber was transparent. The first case was produced by a stone splinter which was located back of the iris. In the second case the injury was produced by a splinter of steel. This patient could see red with the injured eye. According to Fuchs this condition is due to the extravasation of hemoglobin from the erythrocytes into the vitreous.

McCaw presented a man, aged 40, who suffered sudden loss of vision in the right eye. When seen the next day, the vision of the affected eye was 1/200. Along the branch of the central artery which passed above the macular region, were several small hemorrhages. Of these the one nearest the disc was old, the others recent. No subsequent hemorrhages occurred for ten days, and the vision improved in the lower temporal field. Toward the end of the second week, the patient returned with practically no vision in the right eye, and examination showed a massive hemorrhage into the vitreous.

Meanor reported the case of a married woman, aged 33, in whom hemorrhage of the vitreous occurred at every menstrual period, beginning on the second day of menstruation. The vitreous becomes so cloudy that the fundus cannot be seen, but clears up before the next period. Blood Wassermann, and other tests and examinations, have been negative.

Craig reported vitreous opacities in a child aged 8 years. There were extensive floating opacities. Hemorrhages from protracted labor was the probable cause. Nystagmus was noticed. **Ascher** supplements a former article on the localization and mechanism of a ring shaped hemorrhage into the posterior chamber. An illustration shows the accumulation of the blood in the remote angle between zonula ciliaris, lens and vitreous, and the mechanism of its occurrence. **Perez Jimenez** described the Purkinje phenomenon in vitreous hemorrhage.

OPACITIES OF THE VITREOUS.—**Bookless** showed a child with a gray mass in the vitreous, with arborization of vessels visible at the back of the lens. A week later, a small nodule appeared on the back of the iris. This had increased progressively, and vision was reduced from 1/6 to counting fingers. **Hijikata** wrote on the formation of opacities. **Diechler** reported a case of ring shaped opacity of the vitreous of the right eye. **Holloway** exhibited two cases of snowball opacities of the vitreous. He stated that at least 2 types of vitreous opacities should be differentiated, namely, the snowball opacities and the true cases of synchisis scintillans. (See asteroid hyalitis.) In **Fagin's** case of monolateral congenital amblyopia in a child, the eye was blind since birth, the vitreous filled with exudates, iris atrophied. **Cook** has written on vitreous opacities.

HYALITIS.—**Hokema** treated a severe case of hyalitis with injections of milk. The Wassermann reaction was negative. Several years previous, he had received an intravenous injection of neosalvarsan, five hours after which he complained of opacities in the vitreous. Fifteen days later, light perception only. After a number of milk injections, his vision returned and the retina and the choroid were free from lesion.

PUNCTURE OF THE VITREOUS.—**Blatt** has obtained excellent results from removing from 0.6 to 0.8 c.c. of vitreous humor at intervals of eight days. The procedure is indicated in cases of opacity based on traumatic hemorrhages and inflammation of the uvea and retina, in disseminated choroiditis and in ectogonic infections. The treatment is contraindicated in myopic eyes. **Zur Nedden** has devised a specially constructed canula for use in aspiration of the vitreous body.

CHOLESTERIN IN VITREOUS.—**Chauffard** and his coworkers present evidence that the normal content of cholesterin in the blood may be increased by abnormal production of cholesterin, for which the suprarenals may be responsible; or the hypercholesterinemia may be passive, from retention on account of insufficiency of the liver. The hypercholesterinemia is the common factor which explains its occurrence in the retina. **Black** presented a patient on account of the presence of a great number of glistening particles, of the nature of cholesterin. Jackson suggested that the case might be one of asteroid hyalitis.

ASTEROID HYALITIS.—**Weidler** showed a patient aged 54, Jewish, with asteroid bodies in the vitreous. The left eye had been enucleated for glaucoma eight years before. But the right eye has never shown any symptoms of glaucoma. The ophthalmoscopic study showed the disc oval 7x8 mm., long axis 90°, floating opacities, cholesterin crystals in the vitreous, small and not in great numbers. The rest of the fundus was normal. During the eight years the patient had been under observation, these opacities had increased in number and size. At the present time the vitreous is fairly well filled with oval bodies varying in size from 2x2 mm. to 3x4 mm. They are luminous chain like formations. The author thinks these asteroid bodies are the later stage of the cholesterin crystal formation, after some chemical change has taken place in the vitreous.

Bachstez for several years has observed a picture of scintillating bodies in the vitreous, which showed no luster or refractive surfaces. The opacities appeared as small spherical bodies of a dull white color, which hardly moved when the eyeball was rotated, showing the vitreous to be nonliquified. He had occasion to examine two eyes chemically and found that the small bodies were soluble in hydrochloric acid-ether-alcohol, the usual solvent for fatty lime. Treatment with Sudan gave a delicate reddish color, with Nile blue. Incineration verified the test.

The Retina

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NEW ORLEANS.

This section of the Digest carries the literature from May, 1921, to May, 1922. For previous references see Ophthalmic Literature, 1921, v. 17, p. 153.

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DIGEST OF THE LITERATURE.

COMPARATIVE ANATOMY.—In the retina of phrynosoma cornutum, **Detwiler** and **Laurens** describe an area centralis with deep fovea, where all inner layers of the retina up to the outer nuclear layer are missing. The retina contains only cones, and they are thin and long and vary greatly in shape. With the exception of the foveal area, all cones contain an oil droplet, and many of them a light refracting body. Near the disc a vascular pecten is found. Under ordinary light, the pigment covers the whole cone up to the light refracting body. Only in the fovea are the inner parts of the cones not covered by the pigment.

EMBRYOLOGY.—Examination of human embryos convinces **Maggiore** that the pars optica of the retina ceases to grow in extent after a certain period, while the anterior blind portion continues to grow, and the ora serrata gradually recedes from the cornea. At the same time the great surface development of the orbicularis ciliaris is observed. In fishes, reptiles and amphibiae, the retinal edge corresponds to the root of the iris, the ciliary body being absent. With the advancing differentiation of the ciliary body in the higher vertebrates, the retinal border recedes more and more backwards.

The examination of 54 natural malformations of the larvae of salamandra maculosa leads **Fessler** to various conclusions regarding the developmental mechanism of the eye. As to the retina, he thinks the potentialities of the retinal layer are such that tapetum cells never originate from it. Under certain conditions, the differentiation of the retinal layer will assume abnormal courses, in such a manner that the layer formation of the retina is arrested, and the cells of the retinal layer develop pigment.

In three anencephalic monsters, **Monbrun** studied the *anomalies* of the optic nerve and retina. They go parallel with the arrest of the development of the brain. The disc was found absent, as were also the fibers of the optic nerve; the retina showed normal layer development, but the ganglion cells and the nerve fibers of the retina were entirely absent.

The examination of a case of *microphthalmus* with coloboma and *orbital cyst* by **Van Duyse** showed that four layers of retina were contained in the cyst. The retina of the secondary optic vesicle, not having been able to find room inside of the eye coat, extended backward and downward forming a duplication. The outer layer of the retinal fold joined the surrounding mesoderm and became continuous with the pigment epithelium. Folds of the pigment epithelium layer, just as those of the inner layer of the secondary optic vesicle, may become isolated and thus form cysts. The cavity of an orbital cyst always communicates with the subretinal space.

MEDULLATED NERVE FIBERS.—The influence of medullated nerve fibers upon the size and shape of the *blind spot* is given by **Gradle** in a study of six eyes of five patients, together with an exhaustive review of the literature. The cases were studied with his tangential magnet scotometer (Y. B. v. 13, p. 28). For each case a sketch of the blind spot is given, with a sketch of the fundus condition.

1. A woman aged 35; medullated fibers covered the upper half of the right disc and obliterated the outlines; the blind spot was fairly regularly enlarged, not corresponding in shape to the area of medullated nerve fibers. 2. A woman aged 38; medullated nerve fibers in the upper nasal quadrant of the left disc and some fibers following the superior temporal vessels; the blind spot was moderately enlarged but did not correspond in shape to the mass of fibers. 3. A man aged 43; the nasal border of the right disc was covered by a mass of fibers; the blind spot was some enlarged but did not correspond in size and shape to the mass of fibers. 4. A girl aged 14; the right disc was entirely surrounded by an irregularly shaped mass of medullated fibers; the blind spot was enlarged and corresponded in size and shape to the mass of the fibers. 5. A man aged 70; the lower third of the right disc was covered by medullated fibers; upward from the disc was a small nub of fibers; the blind spot was vertically enlarged, but corresponded neither in shape nor in size to the mass of fibers. 6. The left eye of patient No. 5; on the nasal half a mass of medullated fibers extending 2 to 4 d.d. upward, downward and laterally; the blind spot was enlarged and corresponded in general outline to the ophthalmoscopic picture, but size and detail differed markedly from it.

The examination of these cases leads Gradle, in general, to the conclusions arrived by previous observers: 1. Medullated fibers cause, as a rule, an enlargement of the blind spot. 2. The blind spot seldom corresponds in size or shape to the ophthalmoscopic picture. 3. This disparity indicates that medullated fibers are not opaque to incident light for the entire length of the medullation, and that the degree of opacity cannot be deduced from the ophthalmoscopic picture. 4. The enlargement of the blind spot indicates merely the retinal area prevented from functioning by a sufficiently thick layer of medullated fibers. 5. The term opaque nerve fibers should be discarded for medullated nerve fibers. (See also optic nerve.)

Three cases of medullated nerve fibers occupying the whole disc, excepting the porus, and extending beyond the disc, are reported and depicted by **Kraupa**. He also describes two other manifestations of medullated nerve fibers, each observed in a case. In the one form the disc appeared lighter in the temporal quadrant and showed white radiation at the margin, while the physiologic excavation appeared dark in contrast. In the second type small bright, white spots on the disc are recognized as being due to medullated nerve fibers from the fact that the other disc showed similar spots with marked radial striation.

The various manifestations of medullated nerve fibers on the disc are therefore classified by him thus: 1. Excessive formation of medullated nerve fibers of the whole disc. 2. Medullated nerve fibers on a part of the disc: (a) in form of tufts, (b) spots. The appearance of medullated nerve fibers with other anomalies of the eye is dwelt upon, such as conus and abnormal vascular distribution, and the correlation between them and high myopia; also the cumulation of anomalies as a sign of a "status degenerativus."

The examination of a case of extensive development of medullated nerve fibers by **Hoeg** verified the opinions formerly expressed by him. The blind spot is hardly enlarged with ordinary perimetry. A defect in the field corresponding in size to the extent of the medullated fibers was found only when the object was made as small as 5/2000; this defect was not larger for colored objects.

In the left, highly myopic eye of a 20 year old woman, the patient of **Bliedung,** the disc was entirely covered with medullated nerve fibers excepting in the area of the porus, which appeared greyish red. From the disc, the medullated nerve fibers extended along the upper and lower temporal vessels to the temporal side beyond the macula, leaving a 4x1.5 d.d. horizontally oval area in the macula unaffected. The field showed a ring scotoma. The higher refraction and the medullated nerve fibers in this and similar cases are to be interpreted as symptoms of degeneration based on heredity.

The massive leashes of medullated nerve fibers in the right eye of **Suker's** patient extended well into the periphery of the fundus above and below. The blind spot was enlarged downward. Vision was 20/40.

Disappearance of medullated nerve fibers after embolism of the central artery has been observed by Wagenmann, Sachsalber, Nettleship, and Frost. To these cases **Bachmann** adds a new observation. A man, aged 28 years, with compensated insufficiency of the mitral valve, suddenly became blind in the right eye, eight days before coming under observation. Right pupil was 6 mm., left 4.5 mm. Adjoining the disc, beautiful medullated nerve fibers were found, above and especially below, extending from the disc into the retina and partially covering some of the vessels. On the temporal side of the disc, the retina was white, opaque in an area about 5 d.d. horizontally and 3 d.d. vertically, and gradually faded into the normal retina. The fovea was outlined by a dark grey-red spot over which the opaque retina distinctly projected. No embolus could be seen. The veins were wider, and a large hemorrhage was found above. The opacity of the retina gradually disappeared, and the hemorrhage became absorbed. The homogeneous arrangement of the nerve fibers became replaced by brilliant interrupted fibers, reminding one of frazzled white silk. The disc became pale, showed new capillaries, and the medullated nerve fibers were entirely absorbed at the end of 15 months. In the macula, black grouped foci with glittering particles at the edge appeared. Vision of hand movements eccentrically. Because of the late and gradual atrophy of the medullated fibers, this change is looked upon as an ascending degeneration following destruction of the retina and its ganglion cells.

VASCULAR ANOMALIES.—In the left myopic and strabismic eye of **Danis'** patient, a man aged 24, the disc was covered by a flask shaped mass, a little larger than the normal disc, protruding about 4 D., of pale pink color; the center presented a slight depression from which a vessel came out, passing over the flask and directing itself downward. The vessels for the fundus could be found on the two sides of the band and seemed to sink into the mass at the flask like dilatation. About the region of the disc and along the ribbon like mass, pigmented choroiditic foci existed. Small similar foci were disseminated in the fundus. In the upper nasal quadrant of the posterior lens surface a white star resembling shreds of asbestos was seen. Detailed discussion of the literature follows, and a colored, drawing reproduces the fundus changes.

Both eyes of **Schlivek's** patient, aged 9, showed *persistent hyaloid arteries*. In the right eye, it began at the optic nerve, came forward and, close to the lens, divided into three branches, which subdivided dichotomously into several minute ones. In the left eye, almost the same condition existed, but there were only two branches, which subdivided, and one small single branch.

The blind but pulsating arterial stem projecting about 3 D. from the disc, making several spiral turns in the right eye of a woman, the patient of **Sedwick,** was taken to be a persistent hyaloid artery.

Description of several vascular anomalies is given by **Kraupa,** accompanied by excellent drawings; (a) Arterial: 1. A cilio-retinal ring, seen at the bottom of a shallow depression in the lower half of a left disc; the blood circulated now in the upper, now in the lower part of the ring. 2. Coil of cilio-retinal arteries in a left myopic eye. 3. Connection between a large cilio-retinal artery and a lower trunk on the disc. (b) Venous: 1. Anastomotic connections. 2. Bifurcations. 3. Optico- and retino-ciliary veins in a right myopic eye with circumpapillary atrophy. The veins on the disc united in two main trunks which penetrated into the disc at the nasal margin, and continued in the form of two salmon colored indistinct bands, which after uniting emptied into a typical ciliary vessel; a similar condition was found at the temporal margin, where two retino-ciliary veins communicated with large cilio-retinal vessels. 4. Peculiar corkscrew like venous loop found within the tissue of the lower nasal quadrant of the right eye of a man, aged 28. Fine anastomosis between the venous trunks was seen in addition. No arteriosclerosis was found in the case.

Spiral looping of the retinal artery on the right disc of a woman, aged 45, was observed by **Francis.** The disc was clearly outlined with a moderately large central physiologic cup. The artery, emerging towards the nasal side, branched near the cup brim and crossed a venous branch. Just as it crossed the trunk of the vein near the disc margin, the artery was thrown into a loop of 5 twists, which extended 3 mm. into the vitreous. Arterial pulsation synchronous with the radial pulse could be noticed at the tip of the loop; no other vessels in either eye pulsated.

In the right eye of a woman, aged 23, **Musy** found a congenital anomaly of the inferior temporal artery. It projected in the form of a loop into the vitreous, and the two branches of the loop were entwined around one another; the descending branch returned to the disc near the point of origin of the artery, and then continued in the normal manner in the fundus.

A typical case of *intermittent exophthalmos* of the right eye in a woman, aged 21 years, the patient of **Byers,** showed a fundus as a whole ruddier than normal. Over and around the disc was seen a strikingly large number of venules and arterioles. A number of arteries and veins emerged from the periphery of the disc in the manner of cilio-retinal vessels, and bifurcated over the surface of the disc instead of at the usual distance. Veins and arteries were fuller. Condition improved somewhat after an operation for tubal pregnancy.

EXTENSION OF LAMINA CRIBROSA.—Adopting the nomenclature of **Masselon,** **Danis** reports the case of abnormal extension of the lamina cribrosa in the right eye of a man, aged 25. On the disc, a brilliant, white, nonstriated mass was seen in the horizontal diameter, between the center and the nasal margin; it was directed up and out, partly covered the disc and vessels, spread out in a fan covering all the upper quadrant, and passed over the superior temporal vessels and along the superior nasal vein. Another bifid prolongation was directed to the temporal side. The left eye was amblyopic without any fundus changes. The discussion of the literature is concluded with the statement that the canal of Cloquet, epipapillary membrane and extensions of the lamina cribrosa are essentially identical congenital malformations, all three dependent on a hyperplasia and a nonabsorption or incomplete absorption of the hyaloid neuroglia tissue.

In the left eye of a man with myopic astigmatism and convergent strabismus, the patient of **Musy**, a bluish-grey membrane began on the disc at the bifurcation of the vessels and extended in a horizontal manner into the vitreous. The membrane had only the width of a vein at its origin on the disc and became rapidly wider, thus covering the macular region entirely. It was homogeneous and contained no vessels. The anterior attachment could not be determined.

In the right eye of a man, aged 23, **Danis** found the disc red and the vessels not visible on it. At the center was a small white mass, from which proceeded several white filiform prolongations, which terminated on the retinal arteries. The disc appeared covered with a thin opaque veil. Aside from a typical coloboma of the iris, the other eye was normal.

Veil like formation on disc and retina was observed by **Kraupa** in two cases. In the highly amblyopic eye of a soldier, it extended from the disc as a fine veil towards the macula, where it was attached in the form of a cord. Of the other occurrence in a left amblyopic eye, a good illustration is given. The greatest part of the disc was covered by the white formation, which projected 6 D., and showed fine projections above and below, which were attached to the retina. The veil formation is looked upon as a higher degree of membrana epipapillaris, and resembles those conditions wrongly called persistent Canal of Cloquet.

In the right, highly hyperopic and astigmatic eye of his 20 year old patient, Kraupa found on the upper nasal margin of the disc a white structure, which extended as a narrow zone to the middle of the nasal disc margin; here becoming somewhat wider, it extended in a tortuous cord of the thickness of a vessel for about 5 d.d. into the upper nasal quadrant, always lying in the level of the retina.

Anomalous Pigmentation.—In the right eye of a man, aged 27, complaining of asthenopic symptoms, **Shields** found some distance below the disc small rounded areas of pigmentation, entirely in the retina beneath the inferior temporal vein, arranged somewhat like a bunch of grapes. The condition was looked upon as being congenital.

In a soldier, **Baldino** found alongside of peripheral opacities of the cornea, which in the right eye resembled an arcus senilis, changes in the extreme periphery of each fundus, consisting of round and irregularly angular black pigment deposits; the largest *pigment spots* were most peripheral and were larger than the disc. In the left eye, there was in addition a 2 d.d. area of white connective tissue at the nasal margin of the disc, of trapezoid form with sharp borders. The condition of the left eye was looked upon as a remnant of the hyaloid artery, and the corneal changes as an evidence of disturbed nutrition in a hereditary syphilitic subject.

In the last few years, **Holm** saw the following two cases of grouped retinal pigmentation: 1. Boy, six years old, with normal right eye, showed in the left eye black or grey pigment spots below and nasally, mainly along the inferior nasal vein. The spots were grouped and small, and became larger and fewer towards the periphery. These spots appeared like broken pieces of crockery, and were in several places decidedly in front of the vessels. 2. Boy, 17 years old, with myopia and normal right fundus, showed in the left eye grouped pigmentation along the upper and lower nasal vessels. In this case, also, the spots were in front of the vessels. The macula and the rest of the fundus appeared normal. The pigment in front of the retinal vessels in both cases contrasts with the findings of Hoeg.

In both eyes of a 13 year old blonde girl, the patient of **Hedde**, grouped pigment deposits of the retina were seen. The pigment spots were darker than the intervascular spaces, resembling alligator skin by the peculiar grouping of the different sized spots. The groups were of different sizes, comprising only a few small spots to areas of over disc size. The macula was free but the groups began very near it. In the left eye, the groups were mostly arranged in the upper outer fundus, but were also present nasally and temporally, and increased more towards the periphery; similar conditions, but less extensive, existed in the left eye. The pigment spots in each group were irregularly round, or quadrilateral, with blunt corners. Some groups resembled a macroscopic picture of a section of the lacrimal gland. With the direct method, granulation of the individual spot corresponding to the pigment epithelium could be seen. As in other cases, small nevi were found in the skin. Adopting the theory of Niels-Hoeg, the author believes that thru the stretching incident to the growth of the eye, the congenital pigment areas were broken up into the smaller spots, forming the individual groups.

In his paper **Kraupa** outlines a system of anomalies of the fovea: 1. Fovea too near to, or too far from the disc; 2. Fovea twice normal size; foveolar reflex of twice the normal size with normal foveal reflex; 3. Fovea round or obliquely oval; 4. Absence of foveal and foveolar reflexes; absence of foveolar reflex; an additional larger or small foveal reflex; 5. Abnormal vertical reflexes.

In a girl, 18 years old, with nasal conus and staphyloma in the left eye, the foveola was hardly 1 d.d. from the disc. In a myopic man, aged 18 years, the disc was enlarged and contained a gray-green hole, while the fovea was less than 1 d.d. away from the disc and appeared remarkably small and round. Abnormal dichotomic vertical stripes, which changed their brilliancy with the change of the mirror, were observed in the right eye of a 19 year old man, above the disc and extending beyond the fovea.

In the second part of his paper, he arranges the anomalies of the fundus in the following system, giving examples from his own experience: 1. Grouped *pigmentation* of the retina (melanosis) in the left eye of a 16 year old girl, on the nasal side of the disc, lying in the deepest layers. 2. In the right, normal eye, a 1/4 d.d. *melanoma* of the choroid was found on the temporal side of the disc; the retina over it had a peculiar sheen and seemed slightly elevated, the vessels appearing darker. In another normal eye, a similar melanoma was found on the nasal side of the disc. In a third case, the melonoma was found in the lower periphery of a slightly hyperopic eye; the borders in this case were better marked. Diascleral illumination with the Sachs lamp helps in discovery of these melanomas. Six such cases have been accidentally found in histologic specimens by Fuchs, and a seventh has been observed both with the ophthalmoscope and histologically by v. Szily. During six years he observed 10 melanomas and only 5 melanoma sarcomas; melanomas are therefore easily overlooked. 3. The interpretation of the conditions described by him as small *colobomata of the choroid,* might, as he himself admits, be doubted. A small coloboma in the extreme lower periphery, another one declared by himself as a probable pathologic condition in a myopic eye, and other areas of pigmentation above the disc, one above the fovea and one below the disc, are instances of condition described under this heading. 4. In the periphery of many healthy eyes, he has found one or two sharply defined round red spots of 2 vessel diameters; they are probably local defects of the pigment epithelium. 5. Two illustrations are given of little areas resembling choroiditic foci; their interpretation is still to be found. Excellent drawings illustrate every part of the paper.

In each eye of two sisters, aged 7 and 8 years respectively, **Schott** found a typical *coloboma of the macula,* in the form of a horizontally oval focus of about 3x2 d.d. and 3.5 and 2.5 d.d. The foci were sharply defined, strongly pigmented, and a light crescentic zone of the color of the sclera could be seen between the foci and the fundus. A brother of the father also had macular coloboma. After a thoro discussion of the views on the origin of the coloboma, Schott assumes for his cases a familial congenital anomaly due to defective "Anlage." The anomaly is explained according to the theory of Elschnig, by a proliferation of the two layers of the secondary optic vesicle interfering with the normal development of the mesoderm. As to the nomenclature, coloboma of the macula is not quite correct; the cases should be classed as coloboma of the choroid, sclera and pigment epithelium in the region of the macula.

In a boy, aged 13 years, the patient of **Clausen,** bilateral typical macular coloboma was found without medullated nerve fibers, while his father, aged 39, showed macular coloboma in each eye together with typical medullated nerve fibers. The periphery of the boy's fundi showed salt and pepper changes. The Wassermann was negative. This instance of coloboma in father and son is considered as a proof that the coloboma is an inherited anomaly, and that it does not develop on an inflammatory basis. The presence of medullated nerve fibers in the father's eyes is looked upon as an additional proof of the condition being a congenital anomaly.

In the case of coloboma of the macular region of **Hepburn,** there existed a pearly white center with a definite ectasia on the temporal side of the patch. See also **Gilbert** under Pathology, p. 307.

Retinal Pulse.—Stimulated by the work of Bailliart, **Elliot** undertook to study the subject of retinal pulse. All gradations of the venous pulse are seen, but the arterial pulse flashes out over the whole disc; it is seen when the intraocular pressure passes the pressure of the arteries during the diastole. Bailliart has pointed out that circulation thru the eye is only maintained during a part of the cardiac cycle. The diastolic pulse can be easily seen in most eyes; when slight pressure is exerted on the eyeball, the pulse will suddenly flash into sight. It is not free from risk to continue the pressure, as advised by Bailliart, until the pulse disappears.

Venous pulse differs widely from the arterial pulse. It varies in degree and it is best seen where a vein is passing into the disc or is making a sharp bend; it may concern one branch only or several; an alternating decrease and increase in the vein and depth of the color, and a slow emptying and refilling of the vessel can be noticed, especially when slight pressure is exerted on the eye. The venous pulse is comparatively short in a number of eyes, due to the flow in the vessels being interrupted only during the height of the systole; with gradually increasing pressure from without, the pulse becomes more and more marked. If increasing pressure on the eye produces diastolic arterial pressure together with venous pulse, it will be noted that they alternate. A diagram is given to explain the anatomic and physiologic factors in the causation of the pulse in the retinal arteries and veins, and the relation to the general circulation.

Venous pulse is explained in the diagram as a coincident maximum of pressure from outside of the vein with a minimum pressure within, in the seventh tenth of a second; in the fifth tenth of a second, a maximum pressure within with a minimum on the surface exists. The varying character of the venous pulse is equally explained on the hand of the diagram, as also the appearance of the diastolic pulse and its variation on the varying conditions of pressure. Data derived from careful examination of two hundred eyes are analyzed. Spontaneous pulse was present in both eyes in 46%, absent in both in 40%, and present in one eye only in 14%. Of the two hundred eyes thus examined, spontaneous pulse was present in 49%, absent in 51%. In a certain number of cases, spontaneous pulse was present on one occasion and absent on another.

The force of the pulse also differed on different occasions. In a number of cases, light pressure will increase the pulse already present or will elicit one not previously observed. Continued increase of pressure will abolish all venous pulse, but rarely an increase will be observed until diastolic arterial pressure is produced, then diastolic arterial pulse will be found to be alternating with the venous pulse. In 25.5% of these cases, no spontaneous pulse was present and none could be produced by pressure. Here Bailliart's explanation is quoted, that the venous exit pressure lies steadily below the intraocular pressure. In some of these cases, the venous pulse will appear on complete relaxation of pressure. In one case, no pulsation could be induced after relaxation, but the pulse appeared when pressure was reapplied. Pulsation, stopped after relaxation of firm pressure, reappears after further application of light pressure.

If the pressure has increased to the producing of diastolic arterial pulse and pressure is now released, the disc blushes pink, the veins are distended and the venous pulse is abolished for the moment. After a short while, seconds or minutes, disc and veins become normal and pulse returns. Pressure on the eye empties the choroidal reservoir, and leads to a lowering of intraocular pressure. The probable explanation for the appearances observed after relaxation of the digital pressure is that intraocular pressure falls temporarily as a result of the emptying of the choroidal reservoir, and the arteries become overdistended as a result of the obstruction to the onflow of the blood thru the capillaries and veins.

As to the possible influence of the pressure of the arteries upon the veins in the production of a venous pulse, the condition for study were found suitable in 35 patients with 56 eyes. The lesson running thru the whole appears to be that there is no connection whatever in the manner in which the artery is crossed by the vein and the venous pulse therein, or that other factors enter into the case. Venous pulse seen in connection with the crossing of a vein by an artery is usually noted on the cardiac side of compression.

As to the relationship of venous pulse to glaucoma, Elliot believes that a marked venous pulse is a significant feature in glaucoma cases, tho he possesses no figures at present on that question. In glaucomatous eyes with marked pulsation before operation, disappearance or marked diminution of pulsation has been found in a number of instances after relief of tension, but marked venous pulsation is not an invariable feature of glaucoma. Mydriatics will sometimes cause marked increase of venous pulsation, in other instances the influence is negligible. Running thru all these problems, there is an element which leaves the impression that there is some very important factor which we have hitherto been unable to identify or comprehend. It may have something to do with the anatomic and physical conditions which govern the escape of blood thru the ocular tunics.

Locomotion pulse was observed by **Zentmayer** in the entire retinal arterial tree of the right eye of a man, aged 24 years, with aortic regurgitation and beginning proptosis of that eye.

BLOOD PRESSURE AND RETINAL CIRCULATION.—During their studies of the comparative pressure in the blood vessels of the iris and retina, which **Magitot** and **Bailliart** undertook on the cat, it was found that minimum and maximum vascular pressures were practically the same in the vessels of the retina and iris. Stimulation of the sympathetic cervical ganglion produced a slight contraction of the vessels, mydriasis and lowering of the intraocular tension. Section of the sympathetic brought about the opposite symptoms, dilatation of the vessels and increase of the intraocular tension. The work of **Ploman** with regard to sedimentation of the red corpuscles and breaking up of the blood column in the retinal vessels has already been mentioned, page 4. Breaking of the blood column in 3 seconds is pathologic.

In a number of cases **Elschnig** could prove that the granular appearance of the blood stream in the retinal vessels produced by the pressure on the eye runs parallel with the precipitation figures of the blood corpuscles in citrated blood. Marked discrepancy can be found with abnormal blood conditions; in two cases of leucemia rapid appearance of the granulation in the blood stream was observed.

Examining ten patients according to the technic of Bailliart, in a sitting and reclining position, **Salvati** found that the retinal arterial pressure was equal in the two position. In anemias Magitot had found the pressure higher in a reclining position.

In his entoptic experiments on retinal circulation, **Ebbecke** used a glass box hermetically fitting on the eye, in which the pressure could be varied. Pressure of 10 to 30 mm. Hg. made the rhythmically pulsating vascular tree become visible if a bright surface was regarded. This is explained as locomotion pulse of the retinal vessels. Because of the weaker circulation in the periphery of the retina, the pulsating vessels become visible first in the periphery, and obstruction of the field with increased pressure begins also in the periphery. A dark adapted eye observes after release of the pressure, from a bright illuminated disc in the place of the blind spot projections gradually advancing to the center of the field and encircling the point of fixation; this figure also shows coloring. The experiments show that the eye with diminished blood supply behaves like a dark adapted eye, and a vasomotor mechanism of adaptation is therefore made probable. Corresponding to the degree of the blood supply, the sensory epithelium is adapted to a certain intensity of stimulus which is the basis for the light effect.

In his experiments on flicker and blinking vision, **Ebbecke** found it to differ from ordinary constant vision in the following: 1. The luminosity of well lighted surfaces is increased, that of feebly illuminated surfaces decreased. 2. Saturation of colored surfaces is diminished, or the color tint entirely abolished. 3. Contrast effect is increased. 4. Irradiations in contrast is increased. 5. Subjective phenomena, such as fovea, macula and blind spot are very clear. 6. Strongly illuminated orange and yellow show a change to green. 7. Strongly illuminated white surfaces appear near the critical frequency violet or purple. 8. Such a surface, appearing violet, shows after a momentary lid closure a central grey area as a symptom of the dark adaptation, and its rapidity; demonstrating the differences in the critical frequency of central and peripheral vision.

On twenty-two young persons, **Leplat** undertook to study the influence of *adrenalin* on intraocular tension and the retinal blood pressure. The drug was given in hypodermic injections, and measurements of the systolic arterial pressure both in the brachial and in the retinal arteries were taken. In all cases the increase in pressure in the retinal artery and in the brachial followed a similar curve, but generally with less increase in the former. The diastolic arterial pressure measured on the disc varied as that of the radial artery. The constriction of the retinal artery did not appear very marked. In the veins, increased pressure was also observed, but this increase was not constant and the curves of arterial and venous pressure did not run parallel. The intraocular tension was not increased in any of the experiments.

Leplat shows the clinical importance of the retinal circulation. 1. A girl, aged 16, with epilepsy, suffered with daily attacks of blindness. With normal blood pressure, the pressure in her retinal arteries rose from 25-60 to 50-90, in consequence of local angiospasm. 2. In a man aged 60, with retinal hemorrhages and bad heart, the systolic arterial pressure in the retinal arteries was found greatly increased. 3. In a man aged 52, with normal vision but attacks of foggy vision, intraocular tension was normal but great hyperpressure existed in the retinal arteries. General treatment and purges reduced the retinal arterial pressure and the foggy vision.

LIMITS OF LIGHT STIMULI.—Using a red or blue, 2 mm. circle, placed in such position that it formed with the visual line a 20 minute angle temporally or nasally above, **Pieron** determined the liminal intensity for the various durations of stimuli. This is done for the purpose of isolated stimulation of the peripheral cones by the red light, and of the rods by the blue light. The curve of the liminal energy, as a function of the duration of stimulus, corresponds (with red light) to the curve of foveal vision with white light; with blue light the curve is similar, but the time constants are different. The conclusion is derived from this, that peripherally the process of light stimulation runs a faster course in the rods than in the cones.

The influence of the size of the object on the liminal energy, with complete dark adaptation, was examined by **Pieron** in definite regions of the retina: in the upper outer and the lower inner retinal quadrants at 20 degrees from the visual line. The round object was variable as to luminosity and size, and the light was either red or blue. Thus stimulating, as he believes, with the red light the peripheral cones and with the blue light the rods, he found an incomplete local stimulus summation. The amount of summation is about seven times as great for the peripheral cones as for the rods of the same region.

With a specially arranged apparatus, Pieron studied the variation of liminal energy for the stimulus duration of foveal vision. The stimulus duration for light adaptation was between 0.66 and 3,200, for dark adaptation between 104 and 3,400. The energy quantum (product of intensity and duration of stimulus was between 263 and 3,200 for dark adaptations and 226 and 3,200 for light adaptation. In light and dark adaptation there is a limit for the summation, below which the minimum of intensity does not descend, if the duration of the stimulus is increased; this occurs only after a duration of three seconds. The curve indicates that the variation of the energy minimum is analogous to the law of Lapicque for electric stimulation of the motor nerves.

Experiments on the effect produced by *illumination of eccentric retina* on the clearness of central vision undertaken by **Schjelderup** led him to the following: With constant stimulus intensity, the threshold value is the linear function of the luminosity of the background; with constant luminosity of the background, the threshold value is the direct function of the stimulus intensity. The threshold increases proportionately with the luminosity of the background. Neither adaptation, simultaneous contrast nor central psychic repression are of any influence. An interrelation of the visual areas different from the simultaneous contrast must be assumed, which is slower the bigger the stimulus. It is based on products of metabolism of the sensory function of the retina; stimulation of the retina produces depressing products which also affect the neighborhood.

The experiments of **Dittmers** were undertaken to study the recognition of changes in the sensation of an almost colorless light produced by an increase of the same light. If field of fixation and surrounding background are of the same luminosity, the discrimination threshold has a minimal value, and increases with an increase of luminosity of the background over the field of fixation, or with a diminution of the background luminosity below that of the field of fixation. With constant background luminosity and varying field of fixation, the relative discrimination threshold increases with increased luminosity, in which case the field of fixation will show a minimal relative discrimination threshold, compared with fields of luminosity situated at adjacent points of the illumination scale.

AFTER IMAGES.—Thru a 1 mm. wide and 30 mm. long, illuminated slit, which could be passed with varying velocities in front of a fixed light point, **Froehlich** studied the flicker symptom. It was more marked and lasted longer the stronger, the longer and the more frequent the illumination. The various phases of after images could not be observed. If no great light intensities are used, the true typical phases of after images are present, and the oscillation extends then to one of several of the bright phases of after images. Similar conditions also were observed with colored lights; the oscillations of the complementary colored after image phase are also complementary. The oscillating light sensations in the field are pathologic and correspond to a beginning scintillating scotoma; the oscillations are about 20 per second.

With his method, similar to that used in the study of periodic images, Froehlich finds that the mutual influence of adjoining areas or visual areas is only apparent and due to periodic after images of various luminosities and rapidities; this difference in the phase of the after images is the basis of the contrast. Dispersed light is therefore the cause of the contrast.

The after images produced by a moving illuminated slit were studied by **Froehlich.** The positive phase of after image is called Hering's after image; it depends on the intensity and the color of the light; it always has the same color as the slit. The second positive phase of after image, the Purkinje after image, is even more dependent on the light intensity. With moderate illumination it develops out of the third positive phase, but with strong stimulations it is separated from it by a narrow dark phase. It is colorless with colorless light; with colored light it is always complementary; just as Hering's after image, it is absent at the point of clear vision. The third positive after image is remarkable for its long duration, with stronger stimulus it lasts longer; it depends on the adaptation of the eye. It is much less bright than the Purkinje after image; it has the same color as the stimulus. In dark adapted eyes there is, under certain conditions, a fourth phase of positive after image to be observed. The intervening dark phases are also of varying duration and darkness. Similar conditions are noticed with fixed bright objects. According to Froehlich these processes do not occur in the retina but in the central nervous system.

The experiments regarding *comfortable luminosity* differences are reported by **Kallenbach.** Exact measurements were made to determine the time necessary for an observer again to recognize the test objects after a change of illumination. The results are given in tables, but the experiments are still to be concluded.

In his new investigations concerning after images, **Gutmann** again found decided superiority of the normal over the abnormal color perceiving individual, both as regards the number and duration of the after images.

The latent interval, after which the complementary after image appears, does not depend, according to **Juhasz,** on the intensity of the stimulus, but clearness and duration grow with the intensity of it. If the fixation of a colored object exceeds a certain liminal value, a complementary after image appears, without a previous positive equally colored after image, and the latent period of the after image diminishes after prolonged fixation. The duration of the after image increases with the period of fixation. Projection on two subjectively equal but objectively different surfaces, makes the after image disappear sooner on the brighter field. With objectively equal but subjectively different fields, it disappears sooner on the subjectively brighter one. White light hastens the process of complementary after images.

FIXATION AND PERCEPTION OF MOTION.—In "Use of the Eyes"—in sewing, reading, checking, and copying, etc., the eyes are rarely more than momentarily at rest, **Cobb** asserts; and he lays down the following: 1. Everyday vision involves, as a rule, only momentary fixation, during which most of the details of the total impression are taken in, not by the fovea but by the parafoveal retina. The periphery is highly sensitive to change of stimulus, and to movement which when analyzed as a stimulus resolves itself into changes of stimulation of retinal elements. 2. The adequate stimuli for such vision are à priori by no means identical with those adequate with the foveal retina. 3. Conditions of eye fatigue and eyestrain are to be sought in relation to such performances of the visual organs as are the rule in the course of the ordinary use. Typical eye work, as in reading, for example, consists in successive momentary fixations and in sudden leaps from one point of fixation to the next.

Experiments undertaken by **Carr** and **Hardy** to determine the factors in the perception of relative motion lead them to the following conclusions: 1. Perceptual accuracy was promoted by the difference in size of the two lights or by an increase in their combined area; possibly both may have been operative. 2. Accuracy was favored by an inequality of brightness of the two lights and by decrease of their combined illumination. 3. Extent and motion did not exert any effect upon perceptual ability. 4. Perception was more accurate with faster motion. 5. Most subjects perceived the situation more correctly when the stationary light was fixated, others when the moving light was fixated, and others, again, were able to judge equally well under both conditions of fixation. 6. Some individuals judged more correctly when the stationary light occupied the upper position; with other subjects, the opposite obtained; for some, position was not effective. 7. The influence of fixation indicates that the problem was solved in part by indirect reference of one of the objects to the organism and it is practically impossible to exclude all spatial reference of the objects to the observer. 8. The influence of the position of the stationary light may be explained by the supposition that the subject apprehended the perceptual situation much as tho the two lights constituted the ends of a swinging pendulum. The fact that some objects were not influenced by the stationary lights may be explained by supposing, that they conceived the situation as a compound pendulum with the center of rotation located between the two lights.

According to Hering, objects appear in their true position during voluntary movement of the eyes, not because the position of the eyes is made known to the individual by the ocular muscles. During nystagmus after turning, objects seem to move. To eliminate the influence of the labyrinth on this nystagmus, **Dittler** experimented with an individual who could voluntarily produce nystagmus and to whom during that nystagmus, stationary objects appeared to move. Only by the sensation of the apparent motion of the resting objects could the individual know that he had produced nystagmus, but he could not determine it in the dark room. The after image produced on the retina by a vertical illuminated line produced in this case not the slightest sensation of motion. The same result was made in the nystagmus after turning, and these facts are interpreted as proving the dictum of Hering, that involuntary eye movements do not produce a change of special values of the retina corresponding to the respective position of the eye.

PERIPHERAL VISION. — Data gained from experiments together with mathematical reasoning compelled **Swindle** to make the following statements: 1. Any color that can be seen at the fovea can also be seen at the periphery, tho for a shorter time. 2. People, color blind at the fovea, can be made to see colors in the same way that normal persons see them at the periphery. 3. Reasoning shows that in the swinging stick experiment the indirectly observed end stimulates a greater streak on the retina and should appear to move faster or thru the greater distance. 4. Objects must move either with a greater velocity or with a greater amplitude in the peripheral field in order to detect its motion, as well as the movement of an object nearer the fovea. 5. When the stationary point for fixation is farther away from the moving piece of paper, the judgments are less accurate and the underestimations are greater; the estimations become more accurate as the point of fixation is shifted toward the paper.

The experiments were undertaken on 190 students, and he arrives at the following conclusions: 1. If we start with the fovea as the zero point for measurement, the magnitude of the given retinal zone of a normal or color blind person ranges from zero to the numerical value which represents the entire retina. 2. The more carefully a colored paper is fixated by the normal or the color blind, the sooner it disappears for all regions of the retina. 3. Individuals for whom a given color disappears very soon, when fixated either foveally or peripherally, are color blind in the same sense as the majority of people are color blind at the peripheral retina primarily. 4. Motion and distance are perceived less accurately with the periphery than with the fovea. 5. Motion and distance are underestimated more with the periphery than with the fovea. 6. The swinging stick illusion is not an illusion in the particular sense that it has been assumed. On the contrary, it is an illusion in the sense that the indirectly observed end does not appear to move faster or farther at each swing than it seems to.

The explanation for these deductions is based on the facts, that every color first induces those colors which are most similar to it and its most dissimilar or antagonistic color; further; on the fact that the selfinductive capacity of a color varies directly with the stimulus area; and lastly, on the fact that selfinduction of colors at the peripheral regions of the retina is greater than at the foveal regions. The more rapid color induction at the periphery of the retina is due to the greater number of rods, the rod being the more irritable type of retinal structures. Stimulation of the peripheral retina by a moving object will give an underestimation of the extent of motion, to a greater extent than at the fovea, because the induction among the rods is greater than it is among the cones, and the streak grows shorter with correspondingly greater rapidity.

Observations on the disappearance of a peripheral light spot to a fixing eye were made by **Dunlap.** A 1 cm. light spot of low luminosity at a distance of 1 1/2 meters disappeared within 5 or 6 seconds. The smaller and fainter the spot, the more rapidly it disappeared. In addition to this primary effect on the exposed eye, there exists a secondary effect on the corresponding retinal portion of the nonexposed eye. If the experiment was arranged in such manner that the light spot was visible only to the right or left eye alternately, the light spot was invisible to the one eye after an interval of rest and renewed exposure, if during the rest the other eye had been exposed. If the other eye had not been exposed, or if a noncorresponding retinal portion of the other eye was illuminated, the spot became visible when exposed again. After long exposure of one eye, the light spot is at times invisible to the other eye also. If, thru a screen containing two openings, a light surface was observed in such manner that one eye could observe one opening and the other eye both openings, it was found after long exposure of the first eye that the other eye saw only one opening and that the other opening was physiologically suppressed. This is looked upon as a proof of the central relation of corresponding retinal portions and for the central sensory inhibition.

SPACE PERCEPTION. — There is no reasonable doubt, **Spearman** declares, that our spatial perception is at least partly determined by factors of hereditary character. If the origin was to be sought in experience, it must be in some degree that of our ancestors. Two retinal points altho truly corresponding, and normally producing the same visual situation, engendered under certain circumstances different visual situations. In fact the spectacle might be presented of an object moving backward and forward altho, all the time, the place of retinal stimulation remained unchanged.

Taking exception to the statement of Senet, that the retinal image is not inverted, **Hartridge** adduces evidence to prove that it is inverted. The image of an object formed on the retina of the eye of an animal, seen after removal of the sclerotic from behind, is distinctly inverted; the blind spot lies on the temporal side of the point of fixation, the optic nerve lies on the nasal side of the macula; opacities in the media, casting shadows on the retina, are projected into the opposite part of the field; strong light or sharply localized pressure on the sclerotic, away from the cornea, produce a sensation of light which is projected into the opposite field.

RETINAL PROCESSES.—From experiments with different salt solutions on frog eyes, **Beuchelt** concludes that the photoelectric reaction of the retina and the gland currents of the skin are influenced in an identical manner by salt solutions. The retinal currents can, therefore, be imagined to be secretion currents.

Lowenstein and **Kahn** spoke about the electric currents in the retina of the mammal, showing curves obtained.

The fact described by Wassenaar (Y. B. 15, p. 141) of rapidly diminished perception of light intensity, if light strikes the closed lids, is explained by **de Monchy** by the pupil reaction which also occurs with the closed lids.

When one observes 1 of 16 black squares separated by equally large white spaces, the square fixated appears black while the others appear more or less grey. This and similar phenomena **Ohrvall** explains as being due to dispersion circles of the objective light.

Sheard's analysis of our views as to the retinal mechanism and reaction involved in visual sensations are the subject of a review by **Sewall.** The chemical and the mechanical theories of retinal stimulation are reviewed. "The biologist, let alone the purely medical man, has not the training to fit him to critically weigh these physical conceptions. . . . His reasonable attitude is that of an agnostic; to sit tight, look, listen and treat theory tenderly."

Thru experiments, **Rochon-Duvigneaud** endeavored to establish whether double vision existed in a species of small owl, and to what extent. Referring to his paper on simple and double fovea in birds (Y. B. 17, p. 222) he points out that the eyes of nocturnal birds of prey, tho placed frontal, have optical axes that diverge 90 degrees. A light in the median plane placed a short distance from the head of the owl, would produce equal tho feeble contraction of each pupil. Light thrown into one eye only, contracted the pupil of that eye. No consensual reaction existed. In the individual eye the effect of the light, as regards contraction of the pupil, was greatest when the light entered the eye about 20 degrees to the medial side of the optic axis, the effect diminished to the temporal and medial sides from this point. The reason for this lies in the temporal position of the fovea. A light placed about one meter in the median plane in front of the head of the decapitated bird, with the posterior orbital walls removed, the image of the light could be easily watched from behind on each sclera, exactly on the point corresponding to the position of each fovea. These birds have, therefore, a very large angle alpha; but the difficulty must not be overlooked that binocular foveal vision exists, in spite of absence of the consensual pupillary reaction. Further research will have to show the connections of the retina with the centers to the chiasm and from there on.

The colored globules in the retina of the birds may be of importance as regards visual acuity for the different colors and for the appreciation of distances, **Rochon-Duvigneaud, Billard** and **Pollack** declare.

Adaptation, Light Sense.—The connection between disturbances of the field of vision and adaptation was studied by **Zeeman** and **Roelofs** in its usefulness at the clinic. Because of the varying sensibility of the different retinal areas, the influence of the size of the field and the differences in sensibility of different parts of the visual field are apparent during dark adaptation. During dark adaptation, the periphery of the retina increases in sensibility 250 to 500 times compared with the center. In the case of a central scotoma the greatest sensibility will, during the light adaptation, be found at the periphery, but will be much below that of the normal eye; after dark adaptation, the sensibility will increase to normal. If the field is constricted, dark adaptation can only increase the sensibility at the fovea, and it cannot be as high as in the normal. In experiments, a strongly illuminated white sheet of paper was looked at for ten minutes, and then the threshold values were determined after one minute and every three minutes thereafter. Direct relation between the size of the object, the form of the visual field and the course of the adaptation were found. But it is necessary to be careful in making conclusions from the adaptation curve as to the nature of adaptation itself. Exception is taken to the views of Behr and Igersheimer in this respect.

Form sense has nothing to do with light sense, **Percival** reminds us. Very often they are both defective but frequently cases will have excellent form sense in poor illumination, with very defective light sense; and there are cases, for instance in squint, with a low form sense and very high light sense. Rods or something associated with rods must be the percipient elements for light sense. This view is supported by comparative anatomy: diurnal saurians possess only cones; nocturnal lizards have only rods. As night becomes darker, blue is the only color that can be seen and finally we become totally blind—this is the Purkinje phenomenon.

The eyes become fully dark adapted, scotopic, after about 45 minutes. In scotopia, binocular summation of stimuli occurs, not in light adapted eyes. The dilatation of the pupil has nothing to do with this, because scotopia takes a long time to develop. Extension of the cones in dark adapted eyes of different animals and the migration of the pigment granules between rods and cones are alluded to, and it seems tempting to attribute scotopia to the retraction of the pigment granules. The statement of Hess that this movement of pigment has not been proven in mammals is mentioned against this theory. A spectrum of very low intensity viewed by a scotopic eye appears as a colorless streak, with brightness varying in different parts. The bleaching value of different wave lengths of light on a frog's rhodopsin is almost the same as the scotopic luminosity of the spectrum. Rhodopsin or visual purple is supposed to be present in the rods only, and this may explain why astronomers are said to fix faint stars with the parafoveal region.

It seems justified to conclude that light sense is due to a physiologic mechanism independent of that involved in form sense. The latter is concerned with high stimulus values and light adaptation, and is most acute where cones are found; vision of the scotopic eye deals with lights of low intensities, shows absence of color sensation, greatly increased light sense, increased sensitiveness to short wave lengths, and is found where rods and rhodopsin abound. Hence accumulation of visual purple is the essential factor in dark adaptation, and rods are the percipient elements.

Light sense is tested by, first, the light minimum; second, smallest difference of illumination. Light minimum is most affected in diseases of the retina, choroid and glaucoma, light difference chiefly in diseases of the optic nerve. But since light minimum and light difference tests vary in different individuals, no definite standard can be assigned as the normal value of either. Confusion has arisen about the minimum visible for macular form sense from not paying attention to the light sense. Many tests of form sense are really composite tests of light sense, also (Landolt's, Snellen's). As to the light difference, the author considers Weber's law better than that of Fechner. We can recognize a difference between our sensations but cannot measure them. After a long stay in the dark there is no sensation of absolute blackness, but rather of general grayness with patches of lighter tint that move about; this is called, unfortunately, "the intrinsic light of the retina."

With the aid of Fechner's suggestion, Weber's law can be expressed in a simple algebraic form, and it can be seen that Weber's law holds to a much lower limit than usually allowed if the endogenous stimulus be taken into account. In all cases of coal miners' nystagmus which he examined, the light difference, or as he calls it the light minimum, was very greatly increased; while their light difference appeared very little if at all greater than his own. In cases of extensive choroidal atrophy a strong stimulus is required; the light difference is also raised but not to the same extent. In hemeralopia of varied etiology (retinitis pigmentosa, punctata albescens, scurvy, etc.) the state of the visual purple is affected: vision in full illumination is excellent; with the light diminishing, vision suddenly fails; the pupils react well to bright light, not to light that fails to induce vision. This is a proof that the lesion is peripheral and not cortical. In every case the light minimum was enormously increased. It is suggested that in coal miners' nystagmus there is a peculiar form of night blindness, from an increase of the endogenous stimulus. Night blindness is due to the inefficiency in amount or quality of visual purple; hence most cases of hemeralopia should be protected from light as much as possible, while coal miners should wear only slightly tinted glasses.

The fact that neuritis is characterized by an increase in light difference with little or no increase in light minimum, is to be explained, by comparison with a Leyden jar, thru the decreased nerve resistence in consequence of the axis cylinders coming in contact with one another after the breaking up of the medullary sheaths. In optic neuritis the impulses are intermittent, and the light difference must be increased, for a difference in height of successive waves is harder to distinguish than the difference in the height of two level surfaces.

In conclusion the following practical points are emphasized: 1. Every "deputy foreman" in the coal mines should be tested every six months as to his ability to see the "blue cap" of the safety lamp; this would prevent many pit explosions. 2. As to seamen, peripheral vision is of great importance; with good light sense a lower visual acuity due to hyperopia or astigmatism is satisfactory in a seaman; quickness of sight, not ability to determine details is what is wanted. 3. The tests for railway men should be similar to those of seamen, but a slightly contracted field is of little importance; the danger from tobacco or toxic amblyopia is greater with them than with seamen; they should be tested for central scotoma for green and red every six months. A simple test for this is to make the candidate pick out small green or red beads with a pair of forceps. Afterwards the author showed his simple tests for light sense, consisting of white cardboard discs on which black sectors of different angles were marked, which on rotating would produce grey rings of different intensities.

A study of vision in the dark, or in reduced illumination, was undertaken as a war research by **Fluegel.** The experiments were undertaken in the following order and always carried out binocularly: 1. Vision with Snellen's types of the light adapted observer was taken in midday. 2. Then the observer entered the dark room and was light adapted to uniform standard by gazing at a large white sheet illuminated by 1,000 candle power lamp for two minutes, then remaining in the dark for one minute, and in order to test the ability to distinguish light from darkness, he looked into another room at a square patch illuminated by a 100 candle power lamp; the intensity of the illumination could be varied between wide limits. The light from the lamp was covered up at intervals and the observer had to announce dark or light, the illumination being gradually reduced all the time. 3. To test the vision in dim light, an object consisting of a circle with a square resting upon is so as to produce an excrescence to one side of the circle was used. Various sizes were used, and the objects could be rotated in different directions and were lighted by 0.1 candle power. 4. To test the visual activity in rather brighter light, the experiment was carried out as above, but with a 0.2 candle power. The whole procedure was completed in 2 1/2 minutes and was repeated at ten minute intervals, until 50 minutes had elapsed from the moment the observer had entered the dark room.

The conclusions were: 1. For practical purposes, dark adaptation might be considered complete after 40 minutes. 2. For accurate measurement of the light sensitivity, dark adaptation of 20 minutes was sufficient; for test 3, ten minutes; for test 4, one minute. Some observers seem to adapt slowly at the start, but eventually reach the high level of adaptation; others adapt quickly at the start and slowly at the later stages. 3. Visual acuity on Snellen's type does not correlate with light sensitivity at any adaptation time, a fact which supports the theory of dual mechanism for the two kinds of visual ability. 4. Visual acuity in daylight correlates moderately with visual acuity in the dim light. 5. Light sensitivity does not correlate readily with visual acuity in dim light. 6. Visual acuity in dim light only correlates moderately well with visual acuity in rather brighter light. An individual's acuity at one illumination is no guide to his acuity at a different illumination. Visual acuity in daylight correlated best with visual acuity in dim light, and light sensitivity best with visual acuity at the brighter illumination.

Continuing Flugel's work, **Jones** carried on his experiments with his nyctoptometer, consisting of a rectangular box, 6 x 4 5/8 x 3 inches, at one end of which was placed a lamp and at the other end a series of windows with intervals between them, each subtending an angle of 10 degrees at the lamp, and a metal shutter covering each of the windows. Thru these windows, light from the lamp was thrown upon a white screen, 1 meter away from the lamp. By opening different windows, different areas from the central point of the screen could be illuminated; the areas corresponded to different zones of the field of the observer, who fixed a dim red light in the center. The screen was made of white cloth stretched on a wire frame, bent to an arc of a circle of 1 meter radius. Visual acuity was first tested in daylight, and in addition the card was illuminated by a Mazda globe. In the dark room the observer was then light adapted to standard by gazing for 5 minutes at the screen which was illuminated by a 1,000 candle power lamp. After the observer had remained in darkness for 2 minutes, the windows of the instrument were opened in turn, and the light gradually decreased until the observer failed to notice the illuminated area. Each window was opened in turn, and special reading for each window was taken. Complete series of readings were repeated again and again, until 50 minutes had elapsed in order to study the dark adaptation. To test visual acuity in dark adaptation, letters of 6/9 line of Snellen were illuminated by the central window of the instrument; the initial illumination was low and gradually increased until the letters could be read. This was also done with larger letters. In the 12 air pilots examined, Jones found the following: 1. Poor adapters both at the beginning and at the end. 2. Good adapters both at the beginning and at the end. 3. Poor adapters at the beginning, good at the end. 4. Good adapters at the beginning, poor at the end. Only a complete adaptation curve can give full information. Testing for light sensitivity can be confined to a region of 10 degrees around the fovea as the results after 60 degrees give the same ranking; beyond that, no binocular summation occurs. At 20 degrees at the temporal side of the fovea, light sensitivity attains its maximum. Dark adaptation for 16 minutes is for practical purposes sufficient for testing light sensitivity and visual acuity. An individual's visual acuity in daylight is no criterion of his light sensitivity; visual acuity in daylight correlates moderately with visual acuity in dim light, and visual acuity in dim light correlates highly with that in much dimmer light. No inference can be drawn from testing an individual's light sensitivity as to his visual acuity in dim light, or vice versa.

After an extensive review of the literature on seeing in daylight and in the dark, and on pathologic hemeralopia, **von Kleczkowski** reports his own researches. Adapting the Bjerrum method for examination in the dark, he replaced fixation and examining targets by small, white and red electric globes. The inferiority of the macula for low light intensities could be confirmed; in two cases of medullated nerve fibers, marked diminished sensitiveness for low lights was found. In all cases of congenital amblyopia, a ring like circumfoveal scotoma for low light intensities was found. This scotoma was more extensive than the lower light intensity; the peripheral retina was normal; this scotoma could therefore be used to detect simulation of monocular amblyopia.

In optic atrophy, the normal blind spot was larger than found with the Bjerrum method. In two cases of threatened sympathetic ophthalmia, a scotoma was found during the adaptation, larger than the normal blind spot; this might be of diagnostic importance. In glaucoma the scotoma, according to his method, is also larger than with the Bjerrum method. In retinochoroidal inflammations the scotoma, according to the two methods, is the same, but is larger according to the author's method in fresh cases. Intraocular hemorrhages produce extensive disturbances of adaptation. In idiopathic hemeralopia, only insignificant constriction of the field for white, and at times a more extensive one for blue, was found. In these cases annular scotoma and enlarged blind spot were of the same size when examined in the dark or according to Bjerrum's method. In one case the normal blind spot was larger during adaptation than in bright light. His method might be of use in detecting simulations.

Using the photoptometer of Roelofs and Zeeman in his examinations, **Rutgers** studied the adaptation under various conditions: mydriasis, miosis, light of different wave lengths. With wide pupil, the amplitude of adaptation was greater, in miosis it was smaller; the yellow lens of the aged makes them less well adapted for light. From the examination of cases of pigmentary degeneration, detachment, choked disc, optic atrophy, glaucoma and hemianopsia, the conclusion is derived that disturbances of the adaptation do not possess the differential diagnostic value attributed to them by Behr. They can be explained in part by the coexisting abnormal pupillary reactions, in part by the field constrictions. But the field examination in the dark can replace the time consuming examination of adaptation and can be of prognostic value, especially in detachment.

Normal persons and sixty myopes were examined by **de Haan** for vision, the perception circle, perception extent, the optical extension sense and "point vision," with different illumination and different contrasts. Vision is regularly disturbed in myopes, and with diminished illumination and contrast their vision diminishes more rapidly than that of emmetropes. Illumination and contrast have less influence on the optical extention sense. Conclusions are drawn regarding the position of the cones and the distention of the retina in myopes. In the discussion, Waardenburg referred to the work of Steiger, and pointed out the difficulties surrounding an explanation of distention symptoms at the posterior pole in slight myopia. It should be investigated whether two groups of myopes exist, those with and those without distention, and whether school myopes belong to the first. He asks by what the diminution of the light sense was caused, if not by the distention and displacement of the nervous element.

By different methods, **Exner** proved that the Purkinje phenomenon is limited to dark vision, and is entirely absent in daylight vision, contrary to the views held by A. Koenig.

THEORIES OF VISION.—According to the disc or layer theory of color vision of **Dungern**, the outer parts of the cones contain resonators for lights of different wave lengths; these resonators must, to correspond to the various colors, be of different sizes and they must, gradually getting smaller, be distributed over the layers in two rows in such manner, that the outer part of the cone will contain on the one side a resonator for red and green light, in the middle for yellow and blue, and at the end for green and violet light. The resonators lying in a layer are in some manner connected, and are possibly also connected up to the special resonators for white.

Light entering the eye will be reflected by the pigment epithelium and this will lead to interference waves situated in the rods and cones. According to the theory of vision of **Koeppe,** these waves will in acting on the discs of almost equal size of the rods, produce an almost even stimulation and therefore the sensation of grey; because of the unequal size of the discs of the rods, these waves can produce different stimulations corresponding to the different colors. Each size of disc is tuned for a certain wave length.

Koeppe's theory of vision has no foundation in physics, **Weigert** declares, and the transformation of light energy into the energy sensation cannot be explained by a purely "physical theory of vision," as claimed by Koeppe.

It has been shown that light becomes absorbed by certain substances—sensibilators—and that these emit negative electrons which are affecting the albumin molecules. This same process comes into play in seeing, according to the theory of vision given by **Schanz.** Rods and cones cannot be considered as sensitive to visible light, since they cannot absorb it. This can be done by the pigment epithelium; it will emit the electrons, which the rods and cones acting as antennae will receive and transmit to the central nervous system. Light of different wave lengths will produce electrons of different velocity. It does not speak against this theory that albinos see, because pigment has been demonstrated in their eyes.

Examination of Retina.—Our records would be greatly improved could we photograph the fundus, but the difficulties in the way of this procedure are clearly pointed out by **Jackson.** The weak light returning from the fundus under ordinary conditions of ophthalmoscopic examination, would demand a very long and, therefore, impossible exposure. The media absorb the photographically most useful short wave light, and light returned from the fundus is red, which makes least impression on the film. The reflexes from the dioptric surfaces (cornea and lens) readily drown out the fundus image, and must be gotten rid of in photography. For this, "reflexless" systems with dilated pupils are needed, which latter in turn introduces the aberration in the periphery of the dilated pupil.

The structure of the eye itself and its dioptic properties limit the application of photography.

Rays coming from any point but the macula of an emmetrope are not parallel. The hyperopic peripheral portions of the fundus will therefore appear blurred on the photographic plate, focused for the central portion. To this are added the difficulties produced by structures having different depths, like a glaucomatous cup or a swollen disc. Irregular astigmatism, hazy media, etc., multiply the difficulties. The author alludes to his unpublished experiments in this line, to the work of Howe, of Noyes, of Gerloff, of Thorner and Wolff, and, finally, to successes of Dimmer, who took pictures with exposures of 1/20 of a second. Use of the Gullstrand system by Nordenson and Wertheim-Solomonson is mentioned. All these furnish small pictures that are not quite sharp, but they furnish at least an exact topographic outline into which the finer details can be sketched. Possibly transillumination from the nose or pharynx might allow illumination free of reflexes and shorter exposure.

Correctly insisting that it is misleading to describe fundus details in millimeters without any qualifying statement whether real or apparent size is meant, **Jackson** shows the purposes for which dimensions are needed: 1. To indicate the position of a given point in the fundus, or to establish any change in the size of a lesion during the course of the disease. 2. For recording size or position of lesions in case histories for the use of others. The fundus details furnish the best units for measurements: the disc and the retinal vessels. As to location, the retinal vessels furnish an excellent method of description, if lesions are mentioned in their relation to a particular artery or vein. For details of the periphery, or at the disc margin, the clock dial methods is useful. Objective and subjective methods (by charting the field) supplement one another. The accuracy obtained by projecting a scale onto the fundus with larger ophthalmoscopes is not much greater, because of the variation in refraction, than with methods more generally applicable.

In a general paper, **Cantonnet** develops the principles laid down by Broca in 1893, the reason for the use of the *red free light* examination of the eye. Given a strong light it allows, thru greater contrasts, things to be seen which would otherwise escape notice. The early labors in this line by Neuschuler in 1897, Ginestous in 1911, are mentioned, and then the method developed by Vogt and his pupils, as well as the part played by Cantonnet in simplifying the armamentarium, are shown. The choroid is not visible, because the retina appears greyish, opaque, as in a cadaver, the vessels are deep violet; the retina shows numerous reflexes, the macula appears yellow, the nerve fibers are visible. In the diseased eye, red free light helps to recognize affections of the retinal nerve fibers; details on the blood vessels are visible, not seen with ordinary light; hemorrhages and detachment as well as pigment changes in the macula stand out well; but the red free examination of the eye cannot replace that of ordinary light; the choroid is not visible, and it is advisable to have an apparatus which will allow a quick change from yellow to green light.

Red free ophthalmoscopy and its advantages are discussed by **v. Szily.** The central third of the macula appears yellow; this portion enclosing the foveolar reflex should be named macula lutea and the disc sized area should be called the fovea. This method permits study of various pathologic changes, macular affections and observation of retinal fibrillation and folds.

With ordinary bright white light the nerve fibers of the retina become visible even on the temporal side of the macula, especially in the young with dark fundus. But with red free light **Vogt** finds that the peripapillary and perimacular striation can be seen almost every time, when using the direct method. The striation is normally fine, parallel, like basket weaving, with anastomoses of some of the bundles. The parallel arrangement of the bundles is undisturbed over small retinal folds, but they are covered by reflex lines with which they form a grating. The striation begins at the edge of the porus and is continuous from there into the periphery of the retina. The coarsest bundles of fibers are found above and below the disc, going to the temple; the papillomacular bundle is the most delicate one. On the temporal side of the fovea, fibers can be seen coming from above and below enclosing it and forming an arch. The fibrillation to the temporal side of this area is more difficult, and at times the crossing fibers in the raphe can be observed; especially well was this seen in some cases of thrombosis.

Red free light allows the observation of pathologic changes of the nerve striation; it becomes more visible and more coarse, it is interrupted or step like; these changes may disappear and the normal striation can return. If degeneration takes place, partial or total marbling follows; this generally comes on only after months. In retrobulbar neuritis from tobacco and alcohol, a diffuse, fine, white marbling was found between the disc and macula, and the normal striation was absent; as long as the striation was still present there was still some hope of recovery. In a case of occlusion of the central artery, the whole retina appeared marbled, but the fibrillation was preserved in the area supplied by the cilio-retinal artery. In all cases of blindness in existence for one year or longer, total absence of striation was observed. Only in two cases of almost complete amaurosis was there some striation to be seen here and there.

Ophthalmoscopic appearance of the *macula with red free light* is described in detail by **Vogt.** With ordinary light the macula does not appear yellow, only with diffuse daylight and especially with red free light. The yellow area is about one-third the size of the disc; the yellow color is most saturated in the center and gradually fades at the periphery. The yellow colored area which could be called *macula lutea* is about one-third of the whole area enclosed by the foveal rampart, the fovea. The fovea is the whole disc sized depression, and as macula lutea only the central yellow portion of the fovea is to be understood, which also encloses the foveolar reflex. The foveolar reflex is often still visible with red free light when it cannot be discovered with the ordinary light sources; it is produced by the concave mirror of the bottom of the foveal depression; it lies in front of the inner limiting membrane and it moves opposite to observer and mirror.

There are also convex mirror reflexes at the macula. This he observed in both eyes of a boy with transitory protrusion of the left eye of unknown origin; the reflex moved in the same direction and was yellowish and consequently must have originated from a deeper layer; it disappeared after a few weeks. A convex mirror reflex can be present together with the normal concave mirror reflex; this was seen in the right eye of a 30 year old patient with bilateral iridocyclitis; also in embolism of the central artery. In cystoid macular degeneration, a white, consensually moving reflex could be observed, originating on the surface of the bulging internal limiting membrane. The normal foveolar reflex is frequently absent with ordinary light and becomes visible with red free light. Traction folds of the macula will distort the reflex and it may become linear. The circumfoveal reflex ring (Staehli) is best seen with the indirect method; it moves consensually with the observer, being produced by a ring like convex cylindrical mirror. In atrophy of the retina the central macular reflex is absent or broadened. In pathologic cases the yellow colored area may be enlarged or diminished and will show abnormal shape; pigmentation, exudates or tears will partially cover the yellow area or break it up.

The yellow area may be displaced by tumors, detachment and choroiditis; the yellow color of the macula persisted remarkably long in cases of detachment. Gunn's dots and the metallic dots of the retina are mentioned. Beyond the yellow area, white foci on a white background do not show so well with red free as with ordinary light; the star figure in the macula is more striking with ordinary light, but red free light will show more white foci, as in cases of retinitis punctata albescens. Pigmentations of the macula appear black with red free light.

The honeycomb macula is apparently an expression of cystoid degeneration. It was first observed by him in a case of pigmentary degeneration in a boy, aged 13. He has since seen it repeatedly in this disease, always in young individuals. It was also found in detachment, in iridocyclitis, occlusion of the central vein, neuroretinitis of lues and from accessory sinus affection. This macular disturbance could be seen with the slit lamp and microscope in two fresh eyes of children, enucleated because of inflammation after perforating wounds. This macular degeneration concerns the middle and deeper layers of the retina. The cyst walls appear more yellow than the spaces they enclose; in a case of occlusion of the central vein, blood was seen in some of the little cysts. The cysts may disappear or lead to hole formation: "metacystic hole."

With red free light a macular hole is much better visible than under ordinary conditions; it appears black on a white or greyish-white background; the edges are sharper. Still, differential diagnosis between cyst and hole formation is not easy, and cysts might have occasionally been taken for holes. Cystic remnants in the bottom of a hole differentiate metacystic from posttraumatic holes. Several instances of abnormal hole formations are mentioned. A physiologic central pit formation is frequent; it might be mistaken for hole formation. Form, extent and saturation of the yellow area are greatly influenced by pathologic retinal and choroidal processes; but the yellow color of the media (lens) must be taken into consideration. In two patients with healthy eyes, absence of yellow color of the macula was found. The yellow color is absent in albinotic eyes, and no central macular reflex is present. Absence of the yellow area and the macular reflex was also observed in a girl with horizontal nystagmus. The yellow color can disappear during retinitic processes; also behind exudates. For the absence of the yellow color in cases of retinitis of various origin, no explanation can be given; several such cases are mentioned.

As continuation of his former observations with the red free light, **Vogt** discusses the *reflexes* of the inner retinal surface and the preretinal (superficial retinal) folds. The stronger reflexes in red free light are due to the preponderance of short wave light, and to the absence of the veiling produced by the choroidal light. As normal are to be considered the reflex stripes of the vessels and the ragged reflexes alongside of vessels, elevating the limitans interna; similarly, also, the crescentic reflex on the nasal or temporal side of the disc, and a fine vertical preretinal reflex line formation in young individuals. The latter is best seen with undilated pupils; it is occasionally seen with ordinary light; it is not observed in individuals beyond 40, and it seems to be more frequent with strong astigmatism with the rule. It produces, together with the nerve fiber striation, a delicate grating reminding one of the texture of a fabric; it differs from pathologic reflexes by the fineness of the lines; double contours on some lines are occasionally seen; when these reflexes appear together with pathologic double contoured reflex lines (retinal folds), they were occasionally observed to be absent in the region of the reflexes due to folds. In juvenile eyes without vertical *reflexes,* arched reflexes between macula and disc are often seen; these are also visible with ordinary light; their form changes with the direction of light and observation. Pathologic are the preretinal double contoured reflex lines which are due to fold formation; they too concern the border surface between retina and vitreous. These appear on the temporal side of the disc and around the macula in a number of eye affections. In inflammatory conditions of the anterior part of the eye, in accessory sinus affections and in retrobulbar neuritis, *folds around the macula,* the region of the densest choriocapillary loops, are seen, possibly due to collateral edema. Traction folds are found in scars; folds from crowding in tumors and choked disc; folds on the nasal side of the disc are rare. Folds of the inner retinal surface belong to two types: 1. Folds appearing as double contoured reflex lines. 2. True folds, without reflexes. The first are found up to the 40th year, the others later; both are of essentially the same nature, since change of the light and tissue changes will convert type 1 into type 2. When the reflexes are absent, the folds appear dull, plastic, and they are at once recognized as folds.

Preretinal double reflex lines cover nerve fibrillation and retinal vessels; with nerve fibers they produce a grating. Traction folds show no double contours and run more or less parallel in the direction of the pull; those due to edema run radially to the macula, or vertically and even concentrically on the temporal side of the disc. In contusion the lines appear only after a few days and may persist for months (medico-legal importance). At the foveal margin the double reflex lines cease usually, because of the absence of nerve fibers. Traction folds may pass thru the macula. The preretinal lines may be made to move by changes in the light. The folds he has been able to demonstrate in the histologic specimen in two cases, the folds having been studied first with the ophthalmoscope and then with the slit lamp after enucleation; the calculated size of the folds coincided with that found in the histologic specimens. The examination of the fresh enucleated bulbus showed, therefore, true superficial retinal folds, some of which had been covered by reflexes in vivo, while some had been dull.

To the double reflex lines may belong the broken, segmented double lines. Preretinal folds may show branching. Near the vessels the reflex lines seem to be absent, to appear at the same point with change of light. Dull folds are found in all the enumerated diseases and especially in certain senile macular and retinal affections. In the young they have been seen in tumors, retrobulbar abscess, contusion, retinal exudate, etc. Experimentally, the two kinds of folds can be imitated by undulations of glossy and dull paper. After the 40th year, dull folds take the place of the reflecting ones. The dull folds of advancing age are more rarely seen than the reflecting ones of youth. Possibly dull folds must be more extensive to be noticed, while reflecting ones will be visible even tho small. An exudation may cause absence of the reflex. There exist stationary congenital folds without any pathologic relation. A critical review of the literature closes the extensive paper, which is accompanied by beautiful colored illustrations.

In a 17 year old girl, the patient of **Koby,** a more or less transparent membrane seemed with the ophthalmoscope to be present at the posterior pole. Behind it the retinal vessels disappeared in places. The macula was bright red and from it, as from some of the more denser portions of the membrane, radial linear reflexes originated. The function of the eye was perfect and no trauma was known. The condition is assumed to be a remnant of a retinitis some time before, possibly that of a detachment. The reflexes are due to folds of the inner limiting membrane.

Gallemaerts and **Kleefeld** describe the microscopic examination of the living fundus with the aid of the Gullstrand slit lamp and Koeppe contact glass, and allude to the large field of investigation opened thereby.

Contrary to Heine, **Jess** found yellow color at the posterior pole in normal and pathologic cases. A 20 mm. thickness of filtering solution was used together with a micro arc lamp. The method is of great value to show retinal affection in fundus hemorrhages, and might be used in other branches.

Detailed description of red free light examination of the fundus, according to the method of Vogt and the lamp of Cantonnet (Y. B. 17, p. 230), is given by **Nivault**, together with enumeration of the advantages of the method in examination of the normal and especially of the diseased eye, as illustrated by 10 case reports. 1. Renal retinitis, in whom red free light detected finger like extensions towards the disc, with numerous white spots, of a white patch in the macula which alone was visible before, and also a small hemorrhage. 2. Bilateral disseminated choroiditis, in which the soundness of the macula could be established. 3. Myopia, in which only the green light showed cracks in the macular region. 4. Glaucomatous excavation. 5. Detachment of the retina, in which green light allowed a better estimation of the extent of the detachment. 6. A small detachment discovered only by the green light, hidden with the ordinary light by the vitreous opacities. 7. Optic atrophy. 8. Interstitial keratitis. 9. Iritis and vitreous opacities in which the fundus, invisible because of vitreous opacities with ordinary light, became somewhat visible. 10. Incipient cataract. Red free examination allows one to see a larger number of retinal vessels and to study the nerve fibers in the retina. The retina becomes somewhat opaque and the choroid is, therefore, not as easily visible as with ordinary light; in detachment, in macular affections, in retinal hemorrhages, in atrophy of the optic nerve and atrophic choroiditis, it is an invaluable aid.

To show the great value of the slit lamp **Meesmann** reports several cases observed under these conditions: detachments, macular changes, macular hemorrhages, choroidal sarcoma, tent like bulging forward of the inner limiting membrane as a symptom of choked disc. This method of examination allows early diagnosis in some cases. The subretinal exudate in detachment can be seen quite easily.

Referring to his former writing concerning *Gunn's dots* and to the discussion concerning them in the literature since (Y. B. 14, p. 116; Y. B. 1915, p. 153), **Haab** admits that great confusion exists concerning these dots. It seems certain that Frost has been mistaken about them, and that they are only small reflexes, identical with the "metallic" dots of Frost, and with Dimmer's dot like retinal reflexes. Haab himself has not been quite correct in his former writings about them. What Frost depicts as Gunn's dots were apparently only those, now and then visible, small spots in the macula, apparently lying in the pigment epithelium which are of no special importance. Vogt has seen them also in the macula with red free light and calls them glittering dots. At present it cannot be decided what is the basis of these reflexes. They can be seen best with the electric ophthalmoscope and with the Azo globe. He cannot agree that they are best seen with weak illumination, as claimed by the English authors.

With the ophthalmoscope the *ora serrata* becomes visible in the area of a coloboma and in cases of dislocation of the lens forward. **Salzmann** had occasion to see the ora serrata in a 13 year old boy, whose anterior chamber was abolished in consequence of a perforating wound, and in a man aged 55 with luxation of the lens. One can see the anterior surface of the ciliary processes but cannot see their posterior surface. When the ora serrata becomes visible with the ophthalmoscope, a grey reflex is often seen in the extreme periphery, which is probably caused by the peripheral portion of the lens. (See Salzmann under Detachment.)

PATHOLOGIC ANATOMY.

DRAGGING OF RETINA.—Scars in the retina and shrinking exudates can produce a displacement of the retina and of the disc. Ophthalmoscopically, the central vessels will appear displaced to the edge of the disc, the disc itself will have a different shape. v. Szily has given ophthalmoscopic and histologic picture of such cases. **Fuchs** gives a histologic description and sketches the following cases: 1. In the eye of a man, aged 34, enucleated after perforation by a piece of iron, the retina and choroid were perforated on the temporal side of the disc, and the scar displaced the disc and central vessels to the temporal side. 2. In the eye of a 50 year old patient, injured on the nasal side by bird shot three years before, a thick scar comprising the remnants of retina and choroid was found on the nasal side, and the disc appeared displaced thereby to the nasal side, making the portion of the retina adjoining the temporal margin of the disc lie in front of it. As in the first case the scleral canal was unchanged. 3. To the scar from perforation by a piece of glass, in the nasal part of the sclera in the eye of a man, aged 56, a convolution of retina was found adherent; on the nasal side of the disc, the nerve fibers were pulled in such way that the retina began only 1 mm. from the scleral opening, while on the temporal side the retina was pulled over in front of the disc. 4. In the eye with atypical scleral rupture of a 62 year old patient, the retina on the nasal side of the disc was pulled over towards the center of the disc in the form of a fold.

In the following four cases the pull on the retina was exerted by membranes at the anterior margin of the retina. 5. Following scleral perforation near the temporal limbus, cyclitic membrances developed which pulled the anterior retinal margin forward 3.5 mm., without producing detachment of the retina. On the temporal side the outer retinal layers were pulled away from the scleral opening, and appeared pulled over the disc on the nasal side. 6. Cyclitic membranes, after perforation of the nasal corneal margin, pulled the retina on the nasal side to the posterior lens surface, where it became adherent. The disc was pulled to the nasal side, the outer layers of the retina beginning only 1 mm. from the scleral opening; on the temporal side the retina was pulled to the center of the disc. 7. After percussion cap injury 12 years before, the retina on the temporal side was found pulled forward for about 12 mm. by the inflammatory products surrounding the foreign body lying on the ciliary processes. On the nasal side, a cyclitic membrane had elongated the retina for about 2 mm., the outer retinal layers being atrophic at the temporal margin; the amount of displacement could not be estimated: on the nasal side it amounted to about 1 mm. 8. In the eye, blind since childhood, of a 31 year old man, the anterior retinal margin was displaced forward about 3.3 mm. by membranes; the disc was displaced to the temporal side, while on the nasal side sclera, choroid and retina showed supertraction.

Ophthalmoscopically these cases would show the porus displaced nearer to one margin, the disc would have a different shape and the large retinal vessels would have a more straight course, or would have to change direction abruptly according to the point for which they were intended. Histologically these cases showed in the nerve deviation of the glial columns and of the central vessels, displacement of the vascular distribution and displacement of the retina from the margin of the scleral opening; the displacement will lead to rupture of some of the nerve fibers at the lamina. The scleral canal had retained its form in five cases, in the other three supertraction was found. This displacement of the disc is different from the changes found in myopia and ectatic eyes.

The cause for the displacement in the first four cases is clearly due to the force exerted by the scar, while in the last four cases the displacement is said to stand in relation to the extensive gliosis found in three of these cases; gliosis was found only in a small portion in one case of the first group. A slight amount of displacement of the anterior margin of the retina is found in senile eyes, due to the condensation of the vitreous in the anterior portion and its pull on the retina. Increased tension, together with cyclitic membranes, favor the displacement in the anterior portion; therefore the great frequency of this condition in cases of corneal staphyloma. The gliding of the retina on the choroid due to pull and displacement is damaging to rods and cones and leads to gliosis. It is not absolutely essential to have any inflammatory factor.

In the eye of a 51 year old clerk, enucleated because of perforating wound thru broken eye glasses, **Hedinger** and **Vogt** found *folds in the retina,* principally in the inner limiting membrane and nerve fiber layer, partly also in that of the rods and cones. They were found only on the temporal side of the disc, in the region of the macula, and ran vertically. These folds represent the double contoured lines seen with the red free examination (see Y. B. v. 17, p. 231, Vogt). The specimen must be fixed carefully, otherwise the folds will not show.

Histologic examination of an albinotic eye by **Gilbert** confirms the findings of Fritsch and Elschnig, that in *albinism,* an anomalous development of the retina exists, showing as total absence or defective development of the retinal pigment, and as defective development of the macula. In addition a duplication or fold of the retina was found at the temporal margin of the disc, such as has been described in normal fetal eyes by Seefelder, and in an eye with congenital cataract by the author.

One hardly ever chances to examine histologically fresh cases of *chorioretinitis,* which would decide the primary seat of the focus. In old cases the changes in the retina are greater, which is explained as due to the central structure of the retina. In a case of old chorioretinitis examined by **Fuchs,** purely retinal foci were found alongside with the ordinary chorioretinal lesions; in those lesions the pigment epithelium and the choroid were entirely intact, but the outer retinal layers were found destroyed. In this case the origin of the inflammation must have started in the retina. The purely retinal foci must produce scotomas, without corresponding changes visible with the ophthalmoscope.

In most cases, therefore, of chorioretinitis, the disease begins in the choroid, but occasionally cases of primary retinal affection and secondary invasion of the choroid exist, which would finally produce a similar picture to the first class of cases. The choroiditis juxtapapillaris is considered to begin either from the retina, or from the retina and choroid simultaneously. Primary retinal inflammation is probable when, first, the incipient clouding of the retina is exceptionally strong over the focus, thus veiling the retinal vessels, or when accompanied by small hemorrhages; second, when the retina is cloudy over the focus, as well as around the disc and along the larger vessels in parts of the fundus where no circumscript foci exist; third, in the presence of a sector like field defect, corresponding to the focus; and fourth, if after subsidence of the fresh inflammation, only changes of the pigment epithelium remain.

Four cases of *septic retinitis* (Roth) were examined by **Krueckmann.** Clinically the disease was chronic and lasted, in some cases, several months. The autopsy showed endocarditis, small foci in the myocardium, infarcts in the spleen and hemorrhages in many of the organs. The exciting organism showed resemblance to the streptococcus mitior (Schottmueller). No cultures were made from the retina and staining for bacteria in the retina, was negative. Small necrotic foci and hemorrhages with fat granule cells were found in the retina; marginal position of the leucocytes and infiltration of the vessels were absent; the necrosis primarily concerned the ganglion cells and nerve fibers; the ganglion cells appeared at first enlarged, hydropic, with swollen and displaced neuclei; later shrinking and destruction of the ganglion cells followed. The nerve fibers were broadened and broken up. Retinal hemorrhages were found in all layers, partly mixed in with foci of degeneration. In and near the foci, some of the retinal vessels were narrowed and others almost without any lumen. The retinal changes closely coincide with the kidney changes described by Loehlein. The retinal foci are caused by minimal bacteria colonies or single cocci. Since no endotoxins are known of the streptococcus mitior, the changes must have been produced by the living organisms themselves. Exudative changes, less on the retina, more on the disc and anterior part of the uveal tract, resulted from the long process. Iridocyclitis and vitreous opacities result from the more extensive process.

Alluding to the *dots on the retina* described by Elliot in eyes on which couching had been done, **Lister** reports several instances of minute white spots in injured eyes examined both macroscopically and microscopically. In the left eye, removed because of fear of sympathetic ophthalmia, of a Portuguese officer who had been wounded in both eyes by a bursting bomb, the vitreous was found shrunken, leaving a clear space between the hyaloid and the retina, filled with a clear fluid. Dotted over the retina were numerous small white masses, varying from a pin point to a fourth of a millimeter in diameter. In sections these spots consisted of groups of mono- and polymorphonuclear leucocytes with some fibrin; these dots greatly resembled precipitations on the cornea, and by this appearance suggested that they were not derived from the retina.

In another case, a two to three millimeter large mass of exudate was found near the ora serrata; and in another one, lines of exudate were found. The retina beneath the spots was not altered, but some round cell infiltration was found in the walls of the neighboring retinal veins, thrombosis occurring in them. From a study of Elliot's and his own cases, the following conclusions are drawn. 1. The punctuate spots on the retina are a manifestation of chronic septic iridocyclitis, which may go on to chronic panophthalmitis and septic thrombosis of the retinal veins. 2. They are formed in the vitreous and are not derived from the retina. 3. They can only become distinguished or deposited on the retina when the vitreous is shrunken and separated from the retina by a zone of fluid. 4. There is no sign of their being products of degeneration. Excellent photographs of the macroscopic and microscopic specimens accompany the paper.

After reviewing the literature of *cystic degeneration* of the retina and its etiology, **Neame** showed a microphotograph from the eye of a patient, aged 69, with marked cystic degeneration in the periphery of the retina. In the optic nerve, the central artery showed marked increase of the elastic tissue. Then true cysts of the retina in the literature are considered as belonging to the following three groups: (a) Ophthalmoscopically visible cysts, diagnosed as tumors; (b) cysts diagnosed as such; (c) cysts associated with complete detachment of the retina.

To the published cases of Collins belonging to group (c), he adds three cases collected from the literature and five of his own. All had the cardinal features of old injury or inflammation, blindness and complete detachment, and the eyes were removed on account of pain. The cases are arranged in a table, and description of one case, which on several sides had been considered as that of a sarcoma, is given in detail: In the left eye of a man, aged 37, a swelling was seen ophthalmoscopically below, with appearance as of detached retina. On transillumination from below, the pupil appeared black. The enucleated eye showed slight detachment over an extensive area, and below a cyst of 6 mm. diameter with considerable amount of pigment. Histologically, cystic changes in the retina and several cysts over 1 mm. were found.

There is a striking similarity of the histologic appearance of this eye with that of cystic changes in detached retina, and with that of cystic degeneration in normal eyes. The various theories as to the cause of senile and other cystic changes are reviewed, and the opinion expressed that all cases of completely detached retina do not show cystic changes, but that marked arteriosclerosis is associated with fairly marked cystic change in the otherwise normal eye. With a tumor in the eye of a patient, the subject of arteriosclerosis, the possibility of cyst of the retina must be considered.

In the discussion, Parsons related a case of cyst of the retina with perfect transillumination. Mayou had diagnosed cyst in one case, and thought some cured detachment cases were really cysts which had been punctured thru the sclera. Cridland referred to a lady with cyst of the retina he had demonstrated some time before; he had tapped it with a hypodermic needle repeatedly, the cyst filling again. Coulter related a case of an eye removed for scarcoma, in which the pathologic examination revealed cyst of the retina. Richardson Cross said he had removed four or five eyes for a supposed postretinal growth, in which cases the pathologic examination showed no cause for the detachment. Treacher Collins told of a gentleman with tumor of the ciliary body which appeared translucent, and the possibility of a cyst was therefore considered, but further observation proved it to be leucosarcoma. In closing, Neame referred to the possibility of a cyst being opaque because of containing blood pigment, and that a tumor would be translucent because of lack of pigment.

Referring to his paper on *renal retinitis* (Y. B. 17, p. 246), **Hanssen** believes that the histologic findings in the retina of his cases are to be interpreted as of inflammatory nature, an opinion supported by the unmistakable choroidal changes. To determine the rôle of the arteriosclerosis in the retinal changes, he examined the eyes of some twenty cases of extensive general sclerosis, "benign sclerosis," that had come to autopsy. He found the vessels of the eye relatively unchanged, the vessels of choroid and retina not showing similar conditions, and above all, that inflammatory changes in the inner coats of the eye in these cases could be explained by the history and the autopsy record as due to an effection of the kidney. This also speaks against the views of Volhard.

The histologic speciments of disc and retinal tumors from two patients with *tuberous brain sclerosis*, demonstrated by **van der Hoeve**, showed that the tumors originated from the nerve and ganglion cell layers. Edematous degeneration and cystic changes of the retina were found, together with cysts, hemorrhages and lime incrustations of the tumors, which also contained hemosiderin and hematoidin crystals. The tumors consisted of nerve fibers and embryonic cells, as found in the retina of microphthalmus with orbital cyst. The tumors must be classed as neuromas. Small tumor particles in the vitreous and on the retina could be seen; these particles had been observed in vivo with the ophthalmoscope. In the discussion, van der Hoeve, in answer to a question of Rochat, remarked that because of the embryonic character of the tissues, it could not be decided whether the tumors consisted of glial or nerve tissue.

VASCULAR LESIONS.—Contrary to Fuchs' opinion, that the infiltration on the retinal veins in *sympathetic inflammations* is not characteristic for the disease, **Meller** maintains that *periphlebitis* in the retina exists, specific for sympathetic ophthalmia, and that the disease may, under certain conditions, extend along the veins into the retina, and, in this way even reach the retrobulbar portion of the nerve. This is proven by the finding of retinal perivascular infiltration of the kind typical for sympathetic ophthalmia. Such a case is discussed, and the publication of several similar ones promised.

The histologic examination of both eyes with *occlusion of the central artery* of a 63 year old man, is reported by **Scheerer.** The occlusion in the two eyes dated from different periods, and was in one eye an occlusion of the trunk and in the other one an occlusion of a branch. Autopsy demonstrated a high grade luetic *arteriosclerosis.* In the retinal vessels, there were changes in the arterial walls and clots in the lumen of both central arteries and of the left central vein. The clots were fresh and not due to embolism; they are said to have developed during death struggle, or possible later, at points favoring their formation. In the central artery and several of the ciliary arteries were found loose pieces of intima, in all instances near the point of their separation during the enucleation. This is declared to be an artefact due to the traumatism.

The vessel walls showed the hypertrophic thickening of arteriosclerosis. The vessel changes are primary and not due to the importation of atheromatous material. In the left central artery, new formation of an "inner lumen with broad fat mantle" was found at the lamina cribrosa, a condition frequently described and apparently only occurring at this point. This is not the only form of occlusion in the region of the lamina; the lumen can also become eccentrically narrowed by projecting bumps, which show a tendency to calcification. Clots and loose pieces of intima must not be confused with embolisms; they are secondary or agonal formations or artefacts. Hemorrhages, inflammations and, only in rare cases, true embolisms may lead to interruption of the circulation.

According to Kober 5 out of 100 cases of blindness after occlusion of the central artery are bilateral, according to Steindorff, only three. In the case of **Mohr** and **Boehm** of bilateral occlusion, autopsy and histologic examination of both eyes could be had. A man, aged 40, with aortic insufficiency from endocarditis, developed sudden blindness of the left eye and two weeks later that of the right one. Death occurred about two months later. Around the macula, rods and cones were less closely placed, more curved and more oblique; the details indistinct; pigment granules invaded the sensory epithelium. In the fovea, empty spaces with detritus took the place of some of the cones, and the pigment dust invaded more towards the inner layers; in the fovea, the inner layers consisted of a thin, concentrically striped layer with poorly staining nuclei, and of another layer with radial striation, containing few round, better staining nuclei. The balance of the retina showed well preserved outer layer with extensively changed inner layers. In several places of the choroid, round cell infiltration was seen. In both eyes the seat of the occlusion was found to be proximal to the lamina cribrosa. Since the vessels were practically normal, pure embolism from the diseased cardiac valves is considered as proven. A thoro digest of the literature is given.

The histologic examination of a case of *juvenile angiopathy* of the retina, reported by **Wolf**, related to the left eye of a boy, aged 15, who had always seen poorly with that eye and well with the other one. Suddenly, pain and complete blindness began; iritis, glaucoma and vitreous opacities were found. The microscopic examination showed an old iridocyclitis with fresh infiltration, retinitis characterized by extensive vascular disease with large hemorrhages and formation of connective tissue membranes, optic neuritis and glaucoma. In the nerve fiber layer, very near the ora serrata, the structure was interrupted by a round focus with irregular arrangement of the fibers, and containing a few round and oval nuclei; it projected mushroom like, and was looked upon as a healed tubercle. In several other places were similar projections of the nerve fiber layer, but without the round foci. In front of the optic nerve was a large hemorrhage, which was derived from a large full vessel with infiltrated wall. The retinal vessels were thickened, their walls infiltrated with lymphoid cells; some showed a perivascular net of fibrin, and others had proliferation of the intima. The peripheral retinal changes are considered as healed tuberculosis, and those of the disc as exudative retinitis (Coats). The underlying cause is said to have been found in the vascular changes, presenting the picture of tubercular angiopathy of adolescents together with healed tubercules. See also **Cords** under renal retinitis.

To the fifteen cases of primary *tuberculosis* of the retina in the literature, **Eppenstein** adds a new case. The right eye of a 15 year old boy was enucleated because of atrophy of the iris, white masses in the vitreous and scleral ectasia. Histologic examination showed the retina to be entirely detached, folded and thickened by an exudate on the inner surface. The layers were on the whole normal, but contained round nodules having their center mostly in the nerve and ganglion layers. The most anterior nodules consisted of pigment cells; only those near the optic nerve were made up of hemosiderin crystals, lymphocytes and a few large pale epithelioidal cells, with an arrangement around a vessel in some of the nodules. Some vessels appeared occluded, sclerotic; central vessels on the disc and in the nerve were infiltrated with lymphocytes in places. At the end of the intervaginal space was found a granulation consisting of epithelioid cells, lymphocytes and giant cells; a similar one was also seen in the pial sheath; necrosis and bacilli were absent. The nodules in the retina are considered to be of the same character, but with changes due to their greater age. The whole condition is explained as a primary tuberculosis of the retina of ascending character and extending to the optical sheaths, of toxic origin.

The histologic examination of the eyes of **Goerlitz'** patient, who had become *blind after hemorrhage* from a duodenal ulcer, showed intense edema of the discs in the nerve fiber layer; here, also, nodules consisting of polymorphous, partly nucleated formations were seen. Behind the lamina cribrosa, foci of degeneration were found, which resembled those found in disseminated sclerosis. These changes were probably due to the edema of the nerve caused by vascular changes. Early transfusion should be practiced. (See p. 331.)

In the enucleated eye of their six year old patient, **Offret** and **Pascano** found the retina thickened thruout the whole extent, not detached. Several small, shiny tumors were found on the inside of the retina. The tumors consisted of an accumulation of pigment cells, containing space in which *cholesterin* crystals had been imbedded. The *nodules* were surrounded by connective tissue, gradually losing itself in the surrounding neuroglia. The tumors did not extend to the inner limiting membrane, but were adherent to the choroid. Pigment epithelium was detached at the points where the nodules were adherent to the choroid. These nodules are the result of the proliferation of pigment epithelium cells, and the cholesterin crystals are the end product of the metabolism of the intracellular lipoids. The authors believe that the *cholesteatoma* of the retina ought to be recognized as separate clinical entity. (See p. 333.)

In the Ophthalmological Society of Paris, **Monbrun** showed sections of a "Cholesteatoma" from a child's eye, enucleated on account of the detachment and intraocular tumor. These sections showed numerous cholesterin crystals, surrounded by giant cells and large round cells filled with fat droplets. In the discussion, Morax declared the condition to be not one of a new formation but one of a degenerative nature, and Mawas declared that the name "Cholesteatoma" should not be applied to this case.

Three eyes affected with *exudative retinitis*, enucleated because of *supected tumors,* were examined by **Hanssen.** 1. The right eye of a myopic patient, who had been operated for cataract about six years before, was enucleated for severe pain, hypopion, discoloration of iris and yellowish white masses protruding into the vitreous, and slightly increased tension. The examination showed peripheral anterior synechia all around. The retina was totally detached and enclosed only a small remnant of vitreous; it was entirely degenerated, with extensive glia proliferation, and contained numerous pigment cells on the outer surface; these had contributed to the greyish yellow color of the prominences seen with the ophthalmoscope. The pars ciliaris was detached, and a thick ring like connective tissue layer covered the ciliary body. Below, where the pars ciliaris was not detached, intense tissue proliferation was found in the angle between detached retina and ciliary body, extending onto the retinal surface. These membranes did not give the impression as having been the cause for the detachment. The sclera showed remarkable, irregular thin places; at all these points the choroid was in apposition. On the inner surface of the choroid, small nodules were found, consisting of spindle shaped, densely placed cells with multiform nuclei; these nodules are considered as glial in nature, and to be derived from pieces of retina which had remained adherent to the choroid when the detachment occurred. It is assumed that the detachment in this case occurred after the cataract operation on a myopic eye, the peculiar appearance of which, together with the glaucoma, produced the suspicion of tumor.

2. The eye of a four year old child was removed because of inflammation, severe pain and yellowish masses protruding into the vitreous, with glaucoma. The angle of the anterior chamber was occluded, the iris was covered with a thin cellular layer, producing ectropion of the pupillary margin, the retina was in contact with the choroid in the nasal portion. Only a small pointed fold was found here. The retina showed extensive changes of the outer layers, which had been replaced by glia with few nuclei; rods and cones were nowhere found. Small adhesions between retina and choroid were found. Near the ora serrata, dense membranes between retina and choroid were seen. In the temporal half, the retina was entirely detached up to the ora serrata; here the retina was also entirely degenerated with extensive necrosis, producing spaces which were in part communicating with the subretinal exudates, and appeared filled with detritus. Near some necrotic spots, new capillaries were found. The subretinal exudate contained a good deal of cholesterin and degenerated fatty pigment epithelial cells with vacuoles. The case is classed as one of retinitis exudativa (Coats' disease), in spite of the absence of hemorrhages and great vascular changes.

3. The right eye of a nine months old child, tho showing distinct inflammatory symptoms, was enucleated because glioma could not entirely be ruled out. The angle of the anterior chamber was partially obliterated; a thin layer of connective tissue covered the surface of the iris which itself was atrophic. The pigment epithelium was entirely missing in the anterior part, and appeared transformed into a mass of pigmented, dense tissue layers, while on the other side it appeared in the form of irregular layers and masses of pigmented cells. Adjoining this greatly changed pigment epithelium was a mass of organized granulation tissue, which had entirely replaced the retina; this tissue showed numerous small vessels and large blood containing spaces lined with endothelium, and also large hemorrhages without any limiting membrane. In front the granulation tissue was more dense and enclosed tightly the lens. The choroid was thickened, containing sclerotic connective tissue. Nowhere existed symptoms of any specific inflammation or of pus formation. The characteristic of this case is the entire destruction of the retina and its substitution by granulation tissue. The nature of the inflammation could not be determined.

In the histologic examination of the enucleated right eye of their patient with Coats' disease, **Lemoine, Opin** and **Valois** found great thickness of the retina, especially at the equator, miliary aneurisms, obliterating endarteritis, hyalin degeneration of the vessel walls and enormous hyperplasia of the glia, a veritable *gliosis* of the retina.

The histologic examination of the right eye, with exudative retinitis and miliary aneurysms, of **Hata's** patient, showed the retina totally detached and irregularly thickened from glia proliferation. Rods and cones were entirely destroyed; abundant phantom cells and cholesterin crystals were found. In the periphery, ***new capillaries*** and ***miliary aneurysms*** were seen, often grouped, producing the appearance of a cavernoma. Rupture and obliteration of the vessels and perivascular infiltration were found. In the subretinal exudate, pigmented fatty granular cells were numerous. New formations of connective tissue, corresponding to the bluish-white foci seen clinically, were found to consist of coiled up fibers with new vessels; these formations were intimately connected both with retina and choroid, but only the connective tissue and vessels of the latter seemed to pass into the formations. The condition is looked upon as not purely retinal, since the choroid is also involved, and it should be classed as "Chorioretinitis exudativa hemorrhagica chronica." The bluish color of the affected area is due to the gliomatous degeneration and to the extensive intra- and subretinal exudate, while the milky white spots were caused by masses of degeneration especially fatty granular cells (phantom cells of the pigment epithelium).

Histologic examination of their patient's right myopic eye with *multiple aneurysms* by **Miyashita** and **Nisyake** showed some hyperemia of the choroid, but no distinct inflammation, a subretinal exudate of coagulated albumin with numerous granular fat cells and a few polynuclear leucocytes. Near the temporal ora serrata the retina was markedly thickened, tumor like; in this portion the retina was edematous with cavernous spaces, and contained hyperplastic connective tissue of recent formation and consisting of spindle shaped cells with numerous dilated blood vessels. In the inner layers of the retina and in the hyperplastic connective tissue, were seen cross sections of numerous round, elliptical or kidney-shaped blood vessels, at times like a cavernous angioma. Some contained thrombi, and polynuclear leucocytes were found along the inner wall of the vessels. Vessel walls were thin and showed hyalin degeneration. Lymphocytes surrounded the vessels, at times infiltrating them. The lymphocytes were sometimes found together with leucocytes containing eosinophile granules. Hemorrhages were found near the vessels in inner and outer layers of the retina. The retina contained a large quantity of fibrin. Rods and cones were destroyed and the internuclear layer was normal except for the aneurysmal vessels, and the glia fibers were hypertrophic. Applying the histologic findings to the explanation of the clinical picture, the authors enumerate the following: 1. The prominence of the retina was due to thickening of the retina and to subretinal exudate. 2. The red globes were enormously dilated vessels, hemorrhages and thrombi. 3. The large white exudation was made up of granular fat cells in the subretinal space. 4. The small white spots were probably fat cell collections. 5. The sheathing of the vessels was probably caused by infiltration with round cells and granular fat cells. The case is considered one of angiofibromatosis followed by general retinal degeneration, and as standing in close relation with Hippel's disease. (See Miyashita and Nisyake under Aneurysm.)

In the microphthalmic eye with orbital cyst of a man, 37 years old, examined by **Bergmeister**, there were found coloboma of iris and choroid below, complete suppression of development of the pars optica of the retina in the lower half, and embryonic cylindric retinal cells, together with hyperplasia of the optic nerve. The cyst communicated with the nasal half of the subretinal space. The specimens further showed changes due to glaucoma, for which the eye had been enucleated, and tumor development in the inner embryonic retinal layer, consisting of cells with epithelioidal nuclei giving staining reaction of glial tissue; the tumor was very vascular and partly angiomatous. The author believes that the histologic structure of the tumor places it among the cases of *angiogliomatosis* retinae sive gliosis retinae telangiectodes (Meller). This would speak for the congenital origin of this disease, and a secondary glial proliferation cannot be maintained. The peculiar fibrillary structure resembles certain neuroblastomas of the sympathetic system. As to the nomenclature, Meller's classification is to be preferred, or we must speak of *glious tumors.*

The histologic examination of the right eye of a man, aged 75, with *asteroid hyalitis,* enucleated because of glaucoma, by **Verhoeff**, showed numerous small hemorrhages in the inner layers of the retina, which was free from edema excepting on the nasal side of the disc, where a few vacuoles were present. The macula presented changes typical of senile central retinitis, the rods and cones here being completely destroyed, while the pigment epithelium showed degenerative and proliferative changes with formation of hyalin tissue. The retinal ganglion cells were everywhere absent; the vessels showed marked *endovasculitis;* one vessel was found giving off new formed capillaries into the vitreous; in places new capillaries had also formed within the retina.

Effects of Trauma.—With his special apparatus, **Masuda** was able to produce in rabbits' eyes the cloudiness of the retina after commotio without disturbance of other parts of the eye. The *cloudiness of the retina* appeared after four to ten minutes, reached the maximum after two to twelve hours, and began to diminish after twenty-four hours, to be gone within three to five days. In the retina, serous infiltration and severe hyperemia in the choroid were found histologically. In some cases, the sensory epithelium and even the external granular layer were torn off. Only in isolated cases did he find the fine granular and thread like transudate between choroid and retina, described by Baeck and Lohmann. Denig's humps are artefacts or postmortem changes. The clouding of the retina is due to edema and to fine folds with subretinal fluid. The fluid is the result of transitory paralysis of the choroidal vessels. Rapidly disappearing cloudiness left no microscopic changes. Longer persistent ophthalmoscopic changes were seen microscopically as fine folds with edema, or as small tears in the retina. Dark discoloration and pigmentation following the cloudiness showed under the microscope as proliferation of the pigment epithelium, without retinal changes, or as atrophy of the retina and proliferation of the pigment. In some cases, adhesions of the choroid and retina were found. The yellowish white striae often seen are nothing else than detachment, caused by a fine granular mass between retina and choroid. In contusion, lesions of the outer layers of the retina and small subretinal hemorrhages are found.

Referring to the views of Coats, Ogilvie, Fuchs, Kipp and Alt, on the causation of *hole in the macula*, **Williamson** demonstrated specimens from two cases, each showing thrombosis of the retinal vein. 1. Sections from the glaucomatous eye of a woman, aged 62, whose sight had begun to fail 14 years before. The histologic examination showed no cupping of the disc and a thrombosed vein near its margin. In the macula, there was absence of the inner nuclear and inner reticular layers, and the retinal pigment was separated from the choroid. Between the pigment epithelium and the retina was some edematous fluid. *Edema* was also found in the outer molecular layer of the perimacular region. In the accumulation of edematous material between the limitans externa and the pigment epithelium, a cyst was formed; this cyst made the outer layer of the retina undergo a degenerative process, thus allowing formation of the hole.

2. In his other case, that of a patient whose right eye had been blind for 5 years, sections of the eye, enucleated on account of pain and glaucoma, showed slight cupping of the disc and a thrombosed vessel on its side. Some small hemorrhages were seen in the inner layers of the retina. Between disc and macula was found a small collection of fluid between choroid and retina; the retinal pigment could not be made out well. In the macula was a much larger collection of exudate, and the retina showed advanced cystic degeneration. There was no hole in the macula, but had the condition lasted longer, a hole might have formed and possibly a cyst would have developed in the subretinal exudate. In the two cases a toxic influence, shown by the presence of iridocyclitis, acting on the retinal veins, caused thrombosis, and acting on the choroidal capillaries caused edema. This fluid entering between rods and cones and pigment epithelium led to degeneration of the retina and formation of a hole.

DEGENERATIONS.—The histologic examination of the eyes in the case of chloroma of **Sidler-Huguenin** showed a flat detachment on the temporal side. The retina showed diffuse swelling, cystoid degeneration and parenchymatous hemorrhages. The greatest changes were found in the nerve fiber, ganglion and outer nuclear layers. The inner limiting membrane was detached in places; in the nerve fiber layers were found edema and blood corpuscles; in other places, large clefts were seen between the nerve fibers. A few larger hemorrhages were found near the outer nuclear layers and also lifting up the inner limiting membrane. The hemorrhages consisted of red corpuscles mainly, and contained in places mono- and polynuclear leucocytes.

In the eye of his patient, who died of *juvenile amaurotic idiocy* in her fifteenth year, **Okayama** found the sensory epithelial cells entirely absent in the region of the macula and only generally reappearing towards the periphery. The external granular and reticular layers behaved similarly. On the nasal side the layers appeared healthy. The ganglion cells appeared normal, but those in the region of the macula did not stain well and a few seemed degenerated. The pigment epithelium showed remarkable depigmentation, and the pigment had penetrated into the external layers of the retina. The discs were not atrophic. In the brain the pyramidal cells were edematous and degenerated. Okayama believes the Tay-Sachs affection to be one of the ganglion cell layer of the retina, and the juvenile amaurotic idiocy to be an affection of the outer retinal layers.

In an extensive and detailed paper **Bielschowsky** gives his views regarding the histopathology and pathogenesis of *amaurotic idiocy,* with special consideration of the *cerebellar changes.* In the late infantile cases of familial idiocy, failure of the visual apparatus appeared first, to be followed by motor disturbances and progressive idiocy. During the progress, cerebellar disturbance of gait was observed. The disease began in the fourth year, to last three and a half to four years. Loss of sight is explained by the destruction of the rods and cones and outer nuclear layer and the severe changes in the cortex of the calcarine fissure. The cerebellar symptoms were based on severe affection of the cerebellum showing in shrinking of the cortex and extensive glial felting. In a case belonging to the infantile group, the medullary portion of the brain was soft, almost liquid, while the cortex was extremely tough. The cerebellum was atrophic, almost of woody consistency. He finds no atavistic characteristics in these diseases and insists on the objective consideration of these cases. A detailed consideration of the trophic function of the glia and of the changes in the ganglion cells, and the views to be derived therefrom, form an important part of the paper. (See also **Marinesco** under amaurotic idiocy.)

In the Netherlands Ophthalmologic Society **ten Doesschate** demonstrated histologic specimens of retinitis pigmentosa of the dog.

HEMERALOPIA. — Thoroly reviewing *night blindness,* especially in its relation to the experiences during the Great War, **Jess** arrives at the conclusion that no real epidemics of famine hemeralopia had been observed; only sporadic cases in especially predisposed individuals. This is attributed to the good organization of the Commissary Department of the German Army. All cases of night blindness with proven disturbance of adaptation were of the kind and etiology already known before the war. Some important details remain to be worked out. New methods and apparatus have been devised. Aside from the disturbance of adaptation in the retina, other factors, especially those of a psychic nature, can reduce the efficiency of an individual in twilight.

The ophthalmologists of the Central Empires were not able to detect malingering of night blindness with the accuracy required by courtmartials, and this kind of malingering hardly existed in British and American troops; in Mesopotamia, **Smith** cleared it out of the Indian army in a short time. Famine night blindness did not exist in the Great War; it is detected in the same way as idiopathic night blindness.

Idiopathic night blindness is a symptom of bilateral and slowly progressive degeneration of the retina of both eyes. It is hereditary, begins at an early age and takes from 20 to 40 years, leading to complete blindness. Pathologically it is called retinitis pigmentosa, but it may occur without pigmentation; the latter form is more frequent in India. The pupil reaction becomes sluggish during the process, and this symptom is pathognomonic of the disease, even in the cataract cases. The field contracts pari passu with the progress of the disease; this fact is to be used in the examination of malingerers. In illustration of this, the instance of two Sepoys is related, who feigned a very small field, not at all corresponding to the normal fundi, the reaction of the pupils and the supposed duration of illness. They were given the option of doing all kinds of duty or of having a courtmartial, and they promptly accepted duty.

In the discussion, Derby declared many of the cases of night blindness of the British eye bases in France were pure cases of simulation; at times these suspects were given a strong purgative when they went to bed, and were watched how they acted during the night when compelled to get up; the instance of a Y. M. C. A. worker with true retinitis pigmentosa is related. Holloway asked whether the size of the field is not more indicative of the stage than of the duration of the disease. Greenwood, himself had, considerable difficulty in walking around in the dark in France, but he is not night blind nor is he a malingerer. Many people in strange places at night are more or less night blind. De Schweinitz referred to his analysis of 101,127 ocular disorders from various hospitals during the War, containing 132 cases of night blindness; of these 102 were associated with pigmentary degeneration or other types of pigmented chorioretinitis, and the balance showed no fundus changes.

From his experience at the front, **Bell** draws the following conclusions regarding night blindness: 1. True night blindness at the Front, unassociated with signs of disease, was chiefly due to errors of refraction. 2. Intermittent glare from star shells, etc., interfered with normal dark adaptation. 3. Normal eyes may exhibit physiologic variations in power of dark adaptation.

In view of the changes described by Van der Hoeve, Birch-Hirschfeld, Zade, Jess, and Behr, **Schanz** gives his own experiences with patients who had been exposed to strong light of different forms. All showed diminished dark adaptation, especially the older ones. The large number of hemeralopias during the War is explained as a diminished dark adaptation, which existed before the War and only became manifest under the new conditions. More injuries of the retina by light exist than is assumed; the ultraviolet light tires the retina; retinal fatigue and senile degeneration of the macular area are different stages of the same process.

The *hyalin bodies* in the disc of the patient shown by **Hepburn** were associated with night blindness. There was no pigmentary degeneration and no ring scotoma in the case. The fundus was of the albinotic type and the patient was a myope. The night blindness in this case is regarded as a coincidence.

According to **Blatt**, hemeralopia in glaucoma is always a prognostically unfavorable symptom. Such cases end in blindness in spite of all measures. An exact relation exists between the degree of hemeralopia and the malignancy of the glaucoma. (See **Castro** under Circular Atrophy of Choroid and Retina.)

ANGIOMA.—In the case of angioma of the retina, shown by **Rea**, a large white mass was seen in the macular area, and a large vein ran down the disc; the growth appeared to be pushing the retina in front of it. In the discussion, Lister thought the white masses in the case to be decolorized blood, while Treacher Collins did not think angioma a very rare condition, having seen several cases.

ANGIOMATOSIS.—From the Heidelberg Clinic, **Brandt** reports three cases of von Hippel's disease, with histologic examination of two of the cases. A resumé and the further developments in the case which lead von Hippel to the description of the clinical entity named after him are given: the patient noticed, at the age of 23, disturbances of vision of the right, and then the peculiar fundus condition was discovered. About 16 years later, the eye was enucleated because of glaucoma. About seven years later, the patient showed general nervous symptoms and died about one year afterward, (in 1917). The autopsy showed multiple blastomatosis. Since several other kinds of tumors were found in this same patient, all of which are of dysontogenetic group (Schwalbe), it is assumed that the eye tumor also had an independent character.

The son of the patient mentioned developed, at the age of 12 years, disturbance of vision of the left eye. Vitreous opacities and six greatly enlarged vessels were found above the disc; in color, arteries were undistinguishable; from veins the retina appeared uneven with flat elevations, greyish white, opaque, also containing shiny exudates; in the upper periphery a hemorrhage was found, and below a large detachment. Tho the patient reacted to tuberculin, tuberculin treatment had had no influence on the eye condition. A few months later, the eye had to be enucleated on account of glaucoma. The patient's other eye had remained well during the past five years, but his sister, younger by three years, showed at the lower temporal margin of the disc a crescentic prominence and a slate grey discoloration of the macula with a red spot in the center—conditions about which the doubt existed, whether they are to be classified as the beginning of the trouble.

Histologic examination showed a vascular tumor consisting in great part of capillary loops without lumen, with secondary inflammatory reaction in the neighborhood. Near the tumor, the choroid showed lymphoid cell infiltration, was adherent to the retina and showed tendency to connective tissue formation; the larger vessels showed lymphoid cell infiltration of the vessel walls, and the retina appeared edematous, with exudative changes and cystoid degeneration. Glycogen was found in some tumor cells and adjoining retina.

A 12 year old boy, who had become blind in the right eye at the age of 6 years, noticed disturbance of vision of the left eye. The right eye showed annular posterior synechia and cataract; in the left eye the disc was pale red, indistinct, somewhat cloudy; several small preretinal hemorrhages; in the lower nasal and upper temporal periphery, each, were seen a pale red round prominent tumor with entering artery and leaving vein; the arteries were tortuous but not dilated, the veins strongly tortuous and double the normal width; slight detachment of the retina. Wassermann was positive. Glaucoma developed and vascular strands formed in the vitreous. Detachment increased and a new small red tumor developed. Blindness gradually developed, and the patient subsequently died at the age of 15 years with symptoms of a cerebral affection. No autopsy was held. All the members of the patient's family were examined, and only his sister, older by one year, showed the following anomaly of the left fundus: the lower temporal artery appeared markedly tortuous and was covered by connective tissue a short distance below the disc; no change occurred in her eye during the five years of observation.

A soldier, aged 23, complained of poor vision of the right eye. Detachment was found below. Above, an oval, bright red, sausage like tumor, of more than disc size, was seen; to it extended corkscrew like, greatly dilated vessels of bright red color. Immediate enucleation was done in view of the above histories. Histologic examination showed the different tissues of the eye to be practically normal. Near the tumor, the retina showed extensive degenerative changes; it was several times the normal thickness; rods and cones were absent, and the greatly folded retina contained vacuoles and cystic spaces; the glia fibers were increased; in the tumor no glia could be found; the vessels showed similar changes as in case 2. The tumor, 3x 1.5 mm., showed a connective tissue capsule and was lying in the midst of large cystic spaces in the retina; it contained, closely packed together, well developed capillaries with lumen. These were in other places separated by connective tissue, and here the blood was found not only in the capillaries but in the connective tissue; in other places, solid capillaries without lumen were found and compact endothelial tubes. Glycogen could be demonstrated in tumor and adjoining retina. Tho representing an early stage of the disease, the case is remarkable for the severe changes in the retina. Brandt arrives at conclusions entirely different from those of Meller and von Hippel, and thoroly analyzes the literature, comprising 40 cases, of which 14 had been examined histologically. The tumors in these cases are endotheliomas (Borst), beginning from the endothelium of the vessels. The frequent combination of the disease with other tumors in the body is to be explained as a primary multiple appearance of the tumors and not as metastasis.

At the Netherlands Ophthalmological Society, **Meyling** demonstrated a patient with advanced angiomatosis of the retina, and emphasized that, as already pointed out by Berg, this disease cannot be distinguished in the later stages from exudative retinitis.

Since the report of the case of angiomatosis of **Ditroi** (Y. B. 16, p. 168), new blood vessels, new anastomoses and growth of the angioma nodules have developed; the glia in the whole retina has increased, and shiny points have appeared in the periphery and in the macula. Vision has fallen to 6/20, and the field for colors has become narrow, especially below.

The patient of **Tresling,** a man aged 27 years, with angiomatosis, stated that the sight of his left eye had been bad since limewater had gotten into it, one week before, tho the eye had not been inflamed or painful. Three years before, the patient had been treated for obstruction of the nose and dizziness; the vision of fundus of each eye was normal at that time. Vision of the left eye was 2/60, disc margins were hazy, and around the disc and in the macula numerous small white foci and fresh hemorrhages were found. An artery and a vein showed gradually increasing lumen and marked tortuosity, and disappeared in a light red 2 d.d. knot or escutcheon on the temporal side. In the upper fundus, a somewhat smaller, more red, kidney shaped knot was seen. From the further side of each knot, small vessels emerged. The knots projected 8 to 9 D. and showed no pulsation. The field was contracted concentrically with an absolute central scotoma. The right eye was normal. A month later, the enlargement and tortuosity of the vessels had increased, the foci had extended, a star figure was found in the macula, and communication between vein and artery below the knot was seen in the form of small vessels. Later, the vessels entering the larger knot showed various dark colored knob like intumescences, resembling the nodes of a blade of grass. Allusion is made to the two cases of the author (Y. B. Vol. 17, p. 242) and to the literature. See **Bergmeister** under Pathology; and **Okayama** under juvenile amaurotic idiocy.

In two girls and their mother, **Polack** and **Frogé** found identical retinal lesions, while the father and only brother were unaffected. The lesions consisted of greyish, vascularized, hyperplastic bands, greatly resembling those of proliferating retinitis, and of red and orange round nodules which paled under pressure; these latter were seen only in the mother. Wassermann reaction was negative in all three patients. In the discussion, Bailliart suggested the diagnosis of von Hippel's disease.

Aneurysms.—In the right, slightly myopic eye of a boy, aged 15 years, whose sight was failing, **Miyashita** and **Nisyake** found the disc hyperemic, not sharply defined. Vessels were normal, but the peripheral portion of the superior and inferior nasal and temporal vessels was dilated and convoluted. Along the upper and lower temporal vessels, in the periphery, were a large number of small, red, round, elliptical or irregular globes like aneurysms; none were seen on the nasal side. The largest ones were 1/3 to 1/2 d.d.; two of them had a white spot in the center; most of them were small, at times they were set in a row. One, of disc size with grey center, was attached to the superior temporal vein, and the vein seemed to pass thru it. The red globes were mainly along the arteries. White patches of exudate of a silvery brilliancy, and between them small brilliant white spots, were found, all of them lying behind the vessels. An elliptical prominence of 7 D., with some hemorrhages on its surface, was seen in the lower temporal periphery. Tuberculin injection produced general and focal reaction. Enucleation was finally done. (See under Pathology.)

As a chance observation, **Barkan** reports an aneurysm of a macular artery in the eye of an 18 year old girl. The aneurysm was on the disc, appeared twice as long as the diameter of the superior temporal vein, spindle shaped and showed marked pulsation upon pressure on the globe. X-ray examination showed dilatation of the pulmonary artery.

Air Embolism.—The sixteen year old student, the patient of **Hirsch,** suffering from bilateral antrum empyema, experienced during the air insufflation, after washing of the right antrum, sudden blindness of the right eye. The pupil did not react, the palpebral opening was wider than on the left, the fundus appeared diffuse grey, the disc remarkably white; the veins were normally full, but the arteries appeared as white, tiny, empty bands. Gradually blood columns, separated by air spaces, began to show up in the arteries, at first in the periphery; these formations moved slowly towards the center and coalesced; after two or three minutes, the blood column was complete, the fundus assumed its normal color, and vision returned. During a later examination, two transparent, oval platelets were found on the arterial main trunk on the disc; they sank into the excavation during the systole. A review of the literature of the subject leads Hirsch to the following conclusions: The conditions interpreted as vagus irritation and reflexes after air insufflation of the maxillary antrum are to be explained as due to air embolisms. These embolisms, when leading to visual disturbances, produce a typical fundus picture, characterized by pale disc, silvery narrow arteries, with air columns, normal veins and slightly cloudy fundus. Insufflation of the antrum and washings with peroxid are to be avoided.

The paper of Hirsch reminds **Weiss** of a case of spasm of the central artery observed by him and reported in 1912. The rapid cure in the case of Hirsch he considers as speaking against an air embolism and for spasm of the artery. Such spasms are analogous to migrain and scintillating scotoma, and in operations in the nose such spasms are to be borne in mind; they will explain some manifestations attributed to the use of cocain.

Angiospasm.—During the last few years, **Kraupa** and **Hahn** observed four cases of typical embolism, only two of which showed visible emboli, while the other two were based on essential hypertony with luetic mesaortitis. But they believe, that alongside these embolic and arteritic retinal ischemias there exists a clinical entity of ischemia of the retina, which must be considered as a part symptom of a general capillary spasm; they propose to call it acute angiospastic ophthalmopathy. It goes along with or without affection of the renal vessels, and is essentially equivalent to the angiospastic nephropathy. Hereditary or acquired lues produces disposition to the affection; the prognosis is favorable in the young, and iodin treatment is specific.

Their case, quoted in support of the above, was that of a girl almost six years old, who complaining of headaches and visual hallucinations suddenly became blind. The retinas were silvery white, edematous, opaque, and the discs slightly reddened by contrast; the edges of the maculas projected rampart like in comparison with the depressed foveola, which contained a few reddish spots; while the arteries were normally wide, the veins were about 2.5 times the normal width. About eighteen days later, the discs were pale, the retinas still slightly edematous, the veins normal and the arteries narrow. Vision R. E. light perception; L. E. fingers, doubtful. At this time physical examination showed functional spastic changes in all the precapillaries of the body, without affection of the kidney vessels. Papaverin and small doses of iodin were ordered. Gradually the discs became almost normal, vision increased R. E. to .5; L. E. to 1, while the arteries remained unchanged.

After a review of the literature on spasm of the retinal arteries, **Crisp** describes the case observed by him in a girl, aged 14 years, who, returning after a long automobile ride, soon noticed loss of vision in the lower half of the right field. About twelve hours later field examination with the finger showed the lower nasal field of the right eye to be blind, the scotoma being incomplete for a short distance from the fixation point and absolute over the remainder; the current in the upper temporal artery, a little beyond the disc margin, appeared interrupted for a distance of about 1/3 d.d., the empty part being a white band of the same width as the rest of the vessel, and cut off from the normal portions of the artery at an abrupt transverse straight line at either end. The fundus condition remained unchanged during the next two days of observation; and after two weeks the artery appeared as two blood columns of normal width connected by a much narrower red strip. This appearance lasted a little time longer. Exact fundus examination verified the first results, and showed two small, absolute scotomas in the area of indistinct vision. Heart and kidneys were found entirely normal by the family physician. While classing his case as one of spasm, Crisp admits the difficulties in the explanation why only that particular part of the vessel had beeen affected, why the empty part seemed of normal width, and why the artery appeared white.

During two months, the patient of **Valude** and **Gallois** had four short attacks of bilateral blindness. The vision of the right eye became normal, and the fundus showed no changes; the vision of the left eye had been poor for some time, in consequence of spasm of the superior macular artery and edema in its distribution. Heart, vessels and kidneys were normal, but the thyroid was enlarged. This thyroidism acts thru the sympathetic system on the smooth muscle fibers of the vessels.

Because he could see only the upper half of objects with his left eye, the patient of **Koby**, a man aged 40, came under observation. Since the age of 20 he had experienced repeated short attacks of blindness of the left eye, the present one lasting about one month. The right eye was entirely normal. The field of the left one showed a lower hemianopsia almost ending in a horizontal line, and just extending a little below the fixation point. In the dark room, light was perceived in the lower field. The disc was whitish, the upper arteries were greatly reduced in caliber; some were entirely obliterated, appearing as mere threads, and were surrounded by white lines. The veins seemed wider in contrast with the arteries. The foveal reflex was entirely abolished. With red free light, the striation of the nerve fibers was only well marked in the lower half, and even the larger vessels in the lower part of the fundus showed white lines; the macula appeared yellow and marbling could be noticed here. No cause could be found for the obliteration of the artery. Wassermann was negative and the condition is likened to Raynaud's disease and to erythromelalia, and an unpublished case of Marc Landolt is mentioned, of a young woman with cyanosis of the hands and a persistent spasm of the lower temporal arterial branch and corresponding loss of the visual field. In closing, the author dwells on the value of red free light examination, and that a strong source of light be used with the proper screen, direct method and dilated pupil.

Several attacks of sudden loss of vision of the left eye only led by a man aged 34 years, the patient of **Bruner**, to apply for treatment. Vision was 6/6, and the fundi between attacks were entirely normal. During the attack, vision of the left eye diminished to hand movements, and the fundus showed nerve and retina decidedly paler, the arteries contracted as mere threads, while in the veins the regular venous pulse was entirely absent and the blood column appeared granular, broken up. After one to three minutes, the flow of blood in the veins began again, the venous pulse reappeared and the arteries assumed their normal appearance. No red spot was seen in the macula even during attack. Four days after the onset, the patient experienced ten attacks a day, a few days later, there were only two attacks a day, and then attacks ceased entirely. As treatment the patient received sodium bromid, nitroglycerin and cathartics, was ordered meat free diet and was told to reduce his allowance of tobacco; later iodid of potash replaced the bromid. Physical condition was entirely negative. The use of eserin seemed to have reduced the attacks, and a diseased tooth might have led to reflex action.

Embolism.—An embolism can produce symptoms of endarteritis in its neighborhood **Siegrist** maintains, and the finding of endarteritis does not exclude the presence of an embolism. In the majority of cases of occlusion of the central retinal artery, an embolism exists and rarely an endarteritis, or arteriosclerosis with or without thrombus. It is not correct to speak only of endarteritis, since often symptoms of arteriosclerosis are present. In the discussion, Sidler-Huguenin points out that contrary to Siegrist's opinion of an embolism in the central artery, Haab and his pupils have shown that in these cases an affection of the artery, or of the vein, or of both together could be found.

Complete cure of total embolism of the central artery in the right eye of a man, aged 75, with marked arteriosclerosis, is reported by **Rindfleisch.** One-half hour after the onset, all arteries were as thin as threads, and the seat of the embolism is assumed to have been behind the visible part of the artery. Vibratory massage for one minute was used and the eye was bandaged. On the next day, vision, which had been doubtful perception of hand movements, was again normal. In the discussion, Clausen reported a similar case presenting the picture of embolism in the right eye of a woman, aged 52, in whom vision, field and fundus became normal after ten days, massage and K. I. having been used. In both instances, spasm of the vessel and not embolism is assumed to have existed, hence the cure.

In a woman aged 24, with mitral incompetence after rheumatic fever, who five days before noticed a cloud before the left eye, **Hay** found the usual appearances of obstruction of the central artery. The changes were confined to an area bounded on the inner side by the inferior temporal vein, and above by an irregular wavy line which extended outward from the disc, skirted the macular region in a semicircular fashion below, and then passed on to the periphery of the fundus. The area was opaque white, containing a few fine red lines representing the collapsed branches of the inferior temporal artery. On the disc a spindle shaped grayish white swelling, 1½ times the diameter, distended the lumen of the inferior temporal branch. Below the swelling, the artery was a mere thread. Gradually the retina resumed the normal color. The field was contracted in the upper nasal quadrant very near to the fixation point; the injury of the retina had apparently extended further than was visible with the ophthalmoscope. Quoting cases from the literature of the obstruction of branches of the retinal artery, Hay insists that the vitality of the macula is above everything dependent upon the retinal circulation, and the choroidal plexus is more concerned in providing a mechanical support for the retina.

In the case of **Lafon**, vision was lost first in one eye and then in the other one from obstruction (embolism) of the central retinal artery, in a man of 60 with arteriosclerosis. Having used ocular massage for many years, **Wuerdemann** now uses instrumental massage with benefit in different eye affections, such as synechia, glaucoma, embolism of the central artery, optic atrophy, pigmentary degeneration. (See Year Book, V. 17, p. 238.)

Typical cherry red spot in the macula, the retina supplied by the inferior temporal artery pale and bloodless, were found in the right eye of **Lifschutz's** patient, a colored man, 21 years old, whose sight began to fail 8 days before. In addition, the right eye showed a veil like vitreous opacity, a focus of choroiditis of disc size above and to the temporal side of the disc, and above this area an occluded vessel with a beginning of proliferating retinitis. Syphilis was thought the cause of these lesions, tho history was negative and the Wassermann test had not been made.

Occlusion of Vessels After War Gas.—After inhalation of war gas, **Oswald's** patient, a man aged 34 years, developed disease of the vascular system and gradual occlusion of the retinal vessels and degeneration of the inner retinal layers, leading to complete blindness of the left and almost complete blindness of the right eye. War gas, or inhalation of war gas, produces according to Anhoff, increased coagulability and viscosity of the blood, with retardation of the blood flow, leading to thrombosis; the damage of the endothelium is the direct effect of the poison, producing migration of leucocytes; contraction of the blood vessels may be caused thru irritation of the medulla oblongata. The retinal arteries being terminal arteries, interruption in their circulation will immediately lead to severe disturbance, which might not be found in other parts of the body.

ANASTOMOSIS AFTER OCCLUSION OF ARTERY.—Eight cases are reported in the literature of arterial anastomosis forming in the retina after occlusion of the central artery. To these a new case is added by **Rados** and **Candian.** Theirs is the only case in which a direct communicating branch between a ciliary retinal artery and a branch of the central artery could be observed. A woman, aged 22, with mitral insufficiency after rheumatism, developed sudden blindness of the right eye which gradually improved to 6/60 at the end of nineteen days. Four days after the onset, the right pupil was extremely dilated; the retina was white, edematous in the region between the disc and 3 d.d. to the temporal side of the fovea. The area was sharply outlined above and below and somewhat extending beyond the more or less horizontally running vessels; the macula showed the cherry red spot, and the disc appeared normal.

Gradually the formation of a communicating branch between an existing cilio-retinal artery and the superior macular artery, could be observed. At first the cilio-retinal artery was very wide and showed lively pulsation. Gradually the pulsation disappeared, the cilio-retinal artery and the upper macular artery became less wide; and the hitherto thin retinal arteries assumed more normal proportions, and the opacity in the retina disappeared. The communicating vessel must have been, because of its speedy appearance, a dilated communicating existing capillary and not a newly formed vessel. Drawings representing different stages of the process and discussion of the literature complete the case report.

In two cases **Candian** observed arterial anastomosis in the retina in the course of embolism of the central retinal artery. In the first case a cilio-retinal artery was present, from which, a few days after occurrence of the embolism, a fine branch to the upper temporal artery could be followed. With advancing improvement and increasing fullness of the retinal arteries, this communication became very fine again. In the second case two thick arteries appeared near the macula, which could not be followed to the disc. After the retina had lost its opacity, fine communications of these vessels with the main trunks could be observed. It is assumed that in this case both vessels had a communication vertically thru the thickness of the retina.

Dim vision of the right eye began suddenly in **Cayce's** patient, a woman aged 40, and on the next day a white spot was seen near the center of the disc, together with numerous hemorrhages all over the fundus, especially in the lower temporal portion. The arteries could not be made out, and the swelling of the disc had the appearance of choked disc. General examination showed pyelitis and albuminuria.

In a woman, aged 75, the patient of **Aurand,** sudden blindness of the left eye occurred 40 days after the outbreak of herpes on the left forehead, lids, nose and cornea. The disc was white, the arteries and veins were thin; no hemorrhages, no albumin, no sugar. Thrombosis of the central artery from endarteritis obliterans is assumed to be the cause.

Thrombosis of the central retinal artery, with neuritis after influenza, in the left eye of a man, aged 47, is reported by **Cramer.** Blindness developed during three days. Ophthalmoscopic examination was made only after cessation of the fever. The disc was found white, greatly swollen, borders were not distinguishable, since the surrounding retina appeared extensively light greyish-white, opaque. The vessels were normal, but small discrete irregular hemorrhages were found on the disc and in the opaque retina. In the fovea the cherry-red spot was seen. Light was perceived above, below and on the temporal side. After a few days, the swelling of the disc diminished, the disc appearing like a star with raised rays, the opacity of the retina and the cherry red spot disappeared, and light was also perceived on the nasal side. After three weeks, the disc appeared atrophic, well defined, and the vessels narrow. Because of the negative physical examination, Cramer assumes an endarteritic thrombosis of the central artery thru influenza.

ARTERIOSCLEROSIS.—With the ophthalmoscope, the ophthalmologist has a distinct advantage over other diagnosticians, **Zentmayer** reminds us. The retinal vessels, are, as it were, a part of the cerebral circulation; and their changes allow the inference of changes in the cerebral vessels. Retinal changes in interstitial nephritis are due to the sclerotic condition of the vessels; the same pertains also to the renal vessels. Arteriosclerosis may be the cause of repeated spontaneous subconjunctival and lid hemorrhages, a connection denied by some authors. Fugacious edema of the lids and recurring chemosis are also considered symptomatic of arteriosclerosis. Asthenopia may be complained of and also spots before the eyes. Before visible changes of the retinal vessels, hemorrhages máy be found and also bleeding into the anterior chamber, the blood coming from the vessels of the ciliary body. Thickening of the vessel walls may lead to spasm of the vessel and temporary obscuration of vision; it is often the precursor of permanent closure of the retinal vessels.

The case observed by him with Harbridge (see Y. B., v. 4, p. 215) is mentioned, in which the attacks lasted about one minute, beginning in the periphery and being compared to the shimmer from ice clad trees; clearing began in the temporal periphery; the ophthalmoscope showed moderate contraction and flattening of the vessels at the beginning of the attack; when the blindness was complete, the arteries were ribbon like and showed no central reflex; no macular changes were present; the pupil dilated with the loss of vision. Locomotion pulse is observed very infrequently because of being an early appearance. Irregularities in caliber of the vein is an early symptom and makes the vein appear sacculated; later the arteries show copper wire appearance, and the reflex can be found even in the finer twigs; all vessels become more tortuous, and the arterioles become corkscrew like, especially near the disc and the macula, the disc thus having a more capillary appearance; arteries press down and flatten the veins in crossing; in some cases the distal portion of the vein thus crossed shows engorgement and distention; edema of the retina at this point may occur. With increasing sclerosis hemorrhages come. In marked sclerosis, the vein crossed by the artery is diverted so as to lie along both sides of the artery for a short distance before the vein continues in its former direction. (Moore.)

Advanced retinal sclerosis is found in albuminuric retinitis, and the later stages of retinal angiosclerosis resemble that of nephritic retinitis. Venous stasis leads to edema of the retina and disc; thrombi form, producing hemorrhages. Soft white fluffy areas and the macular star are sometimes added to these lesions. The signs of hyperpiesia of Bardsley are mentioned: 1. Uniform distention and fullness of the vessels. 2. Broadening of the light streak. 3. Increased brilliancy of the light streak until it becomes like copper wire. 4. Indentation of the veins by the arteries, leading to back pressure and its consequences. (See Y. B. 14, p. 107.) Adams' findings of the small size and pale color of the arteries are referred to, and to the pinching and indentation of the veins when crossed by the artery, together with the absence of the light reflex at this point.

It must be admitted, tho, that persons with normal blood pressure show similar symptoms. Disease of the retinal vessels may lead to obstruction of the central artery and vein with secondary glaucoma. The anatomic study of circinate retinitis has shown that sclerosis of the capillary vessels is the underlying factor. Many forms of senile central choroiditis are undoubtedly of arteriosclerotic origin, and the typical sclerosis of the choroidal vessels is alluded to. Bull's statement that arteriosclerosis of the ophthalmic artery and internal carotid may affect the optic nerve is mentioned. In his own case of a woman, aged 43 years, dizziness and attacks of bilateral blindness were complained of; finally the right lower field and the upper left field became more or less blind, with corresponding atrophy of the upper half of the right disc and atrophy of the lower half of the left disc; these symptoms are explained by pressure from the ophthalmic artery or internal carotid upon the nerve. The relation between arteriosclerosis and glaucoma is not clear. The relation of retinal arteriosclerosis to that of the general and cerebral circulation is shown on the statistics of Raehlman, Moore, Gunn, Adams and Geis. Anatomically, the changes in the central artery are chiefly of the elastic membrane, the endothelium showing only slight changes. In the retinal vessels, proliferations of the intima is found. The connective tissue coat is thickened, with hyalin changes producing concentric contraction, these changes appearing as white lines; narrowing of the lumen is due to the endothelial proliferation. Prognosis as to life depends on the state of the kidneys and the heart, and the age of the patient; the older the patient the better the prognosis as to life. Extensive vascular retinal changes can be found without impairment of vision. The treatment of ocular conditions is that of the systemic affection. In extensive hemorrhages, weak pilocarpin solution is advisable, and small doses of bichlorid of mercury with Basham's mixture seemed to aid in clearing up retinal edema.

The retinitis of *cardiovascular and renal disease,* Benedict classifies as follows: 1st. Retinitis of acute nephritis, 2nd., retinitis of chronic hypertension and nephritis, 3rd., retinitis of arteriosclerosis, and 4th., retinitis of diabetes. Nephritis may appear in young persons without any sclerosis of the retinal arteries, but it may also come in persons with well developed general or localized arteriosclerosis, with fibrosis or sclerosis of the retinal arteries. Retinitis of arteriosclerosis, as described by Moore (Y. B. 14, p. 107), is separate from retinitis of nephritis; it comes on rather late, and the affection of the kidney resulting from it also leads to retinal changes which have to be distinguished from those of arteriosclerosis purely. It is important from a prognostic and therapeutic standpoint to differentiate between these forms.

The retinitis of *diabetes* probably does not depend upon diabetes alone, but also on the retinal arteriosclerosis. The most prominent factor in retinitis of the vascular system and of nephritis is the sclerosis of the retinal arteries, to which are added other features characteristic of the etiologic factor of the sclerosis. Sclerosis of the retinal vessels varies in appearance as the factors producing the sclerosis. Retinitis of arteriosclerosis is characterized by arteriovenous compression, contracted arteries whose caliber is not materially decreased, pipestem sheathing, arterial plaques, beading, increase in the light reflex and silver wire arteries; the disc may be brick red, hemorrhages are seen in the nerve fiber layers, proliferation of new vessels, tortuosity and increase in the number of arterial twigs of the macula are found; small areas of ischemia and white spots and rarely an edema. With this ophthalmic picture and low blood pressure, cerebral arteriosclerosis would be suspected; with high blood pressure, on the other hand, systemic sclerosis would be suspected. The sclerosis of retinal arteries in arteriosclerotic retinitis has its origin in atherosclerosis or toxic endarteritis, known as secondary arteriosclerosis; most commonly, however, atherosclerosis is acting alone, and when increased blood pressure is added, evidence of nephritis may appear.

Arteriosclerosis of the atheromatous type is a primary disease. Arteriosclerosis of hyperpiesia is the consequence of an effort on the arteries to compensate for the increased blood pressure. Fibrosis and sclerosis of the retinal arteries do not precede hypertension, but follow it. The arteries become elongated, tortuous, the reflex is more prominent, the arteries appear smooth and round. Later the vessels become thickened, there can be seen narrowing of the caliber and of the reflex stripe, arteriovenous compression, increased caliber of the veins, and hemorrhages in the nerve fiber and in the deeper layers; arteries are not beaded, and there is no tendency to the formation of perivascular sheath, or to proliferation of new vessels; small white isolated or confluent plaques, creamy colored exudate with rather bright luster, are found. This type is associated with or followed by nephritis. Retinitis of acute nephritis characterized by intense edema of the nerve and retina, fine hemorrhages and cloudy exudate, may be added to the retinitis of "hypertension and nephritis." Retinitis of nephritis and of hypertension may occur as a result of repeated attacks of nephritis, without preceding hypertension. Retinitis of diabetes is probably due primarily to arteriosclerosis. A diagram explaining the combination of the various forms accompanies the paper.

In a general paper illustrated by excellent drawings and six case histories, **Copps** dwells on the importance of ophthalmoscopic changes in the retinal vessels for the interpretation of general, and especially of cerebral vascular disease. Ophthalmoscopic symptoms of angiosclerosis are fully described with due regard to the literature on the subject.

In his lecture on retinal *hemorrhage,* **Pepper** mentions the case of a man, aged 63, who was admitted after an apoplectic stroke, whose fundi showed arteries small in caliber, tortuous and faintly streaked, together with small hemorrhages. Retinal hemorrhages in the arteriosclerotic are declared to be warnings of cerebral trouble.

HEMORRHAGE.—Sudden blindness of the right eye from retinal hemorrhage and later of the left from the same cause, is reported by **Arrell** in the case of a woman, aged 20 years, with enlargement of the posterior ends of the inferior turbinals. After an operation for *appendicitis,* great improvement in the eye condition set in. In the discussion, Park Lewis referred to the work of De Niord regarding the determination of the presence or absence of focal infection, and to his own conclusions regarding retinal hemorrhages. (Y.B. 15. 148.)

The patient of **Magruder,** with a series of retinal hemorrhages in both eyes, gave a negative history but for repeated tonsillitis, and compression of the abdomen during a foot ball accident. A band of proliferating retinitis, 3 d.d. long formed as a trace of the former hemorrhages.

An ill defined area of glistening greyish tissue in the right macula, apparently on the surface of the retina, which dragging upon the retina had thrown it into radiate folds in the direction of the temporal margin, was found by **Fisher** in a man, aged 24, who had suffered from malaria. Urine was normal and Wasserman was negative. Later, the vessels below seemed to have undergone disturbance, or an anastomotic development, and the appearance of the lower temporal vein suggested some obstruction of its lumen. The condition is considered as the outcome of a hemorrhage from an obstructed retinal vein. A good drawing accompanies the report.

The patient of **Strader,** a man aged 28, complained of a haze before the right eye for a month. Several punctate hemorrhages were found upward and outward from the disc, and one large flame shaped one below it. Some vessels were tortuous. Wassermann was negative, but an apical abscess was found and the tooth extracted. A few days later, the hemorrhages were fairly well absorbed and old linear scars were seen upward and outward from the disc, and the patient stated he had an attack of blurring some 8 or 10 months before. In the discussion, Finnoff commented on the pearly white strands of retinitis proliferans and some probable patches of detachment in the upper nasal periphery.

The patient of **Meanor,** a married woman, aged 33, had hemorrhage of the vitreous occurring at every *menstrual period.* The hemorrhage usually began on the second day of the menses, the vitreous becoming so cloudy that the fundus could not be seen; before the next period the vitreous would clear again. During her two pregnancies, she had hemorrhages every month. During the discussion, several instances of recurrence of various eye conditions during the menses were mentioned.

While playing pool, the patient of **Fagin**, aged 19, was struck in the left eye; three days later blood was found in the anterior chamber, and a few hours afterward the entire globe was filled with blood. At the time of the report the blood was clearing up, but it could not be stated what had happened by the blow, and what had delayed the hemorrhage. In the discussion, Anthony thought the case to be one of secondary glaucoma, and Hooker thought the cloudiness in the anterior chamber to be an inflammatory exudate.

Seven retinal hemorrhages occurred within four months in the left eye of a medical student, aged 22 years, the patient of **Fagin**; different vessels were involved, in the extreme periphery in all instances, but sufficient to reduce vision to counting fingers. The hemorrhages soon cleared and vision became good. Another patient, aged 37 years, had two hemorrhages in about one month, for which no cause could be found. In the discussion, Ellett did not agree that this was a case of hemorrhage.

In three brothers, **McMullen** observed delicate connective tissue formation in the vitreous and on the retinal surface. Vision was interfered with. Of the possible causes, intraocular hemorrhage is probably the only one to be considered.

As examples of retinal hemorrhages in *anemia,* **Pepper** demonstrated the following cases: 1. Female, aged 46, with pernicious anemia and retinal hemorrhages, small vessels and pale discs. 2. A male, aged 36, with acute aplastic anemia following influenza, and anemic vessels in the fundus and diffuse retinal hemorrhages. 3. A man, aged 28, with secondary aplastic anemia, after working with *anilin dyes,* whose eyegrounds showed *optic neuritis,* with abscuration of the disc margins and many hemorrhages. In this group of cases we are at a loss for an explanation of the retinal hemorrhages. Hypertension plays no part in this group. It is likely that the altered blood favors hemorrhages directly, but this would not lead to hemorrhages unless the vessel wall has undergone degenerative changes. The early discovery of retinal hemorrhages is of great value to the clinician as to diagnosis and prognosis.

The changes in the eye of **Zentmayer's** patient with pernicious anemia, were not typical. The fundi were pale, a left low grade neuroretinitis and a pale right disc being present, together with lessened contrast between arteries and veins and a small hemorrhage in the periphery of the right eye from thrombosis of a venule. (See chloroma p. 333.)

The case of *preretinal hemorrhage* reported by **Vogt** is remarkable for the fact that the macula remained intact. A woman, aged 61, who had been under treatment for three years for retinal hemorrhages and proliferating retinitis of the right eye, suddenly developed visual disturbances of the left one. Above the disc, hemorrhagic streaks could be found; between the disc and the macula and around the latter profuse hemorrhages were seen. At the lower central margin of the hemorrhage and several disc diameters above it, greyish white foci were found. Gradual absorption of the hemorrhage took place, altho some of it remained above the disc. Examinations for tuberculosis and lues were negative. A similar case was reported by Schwarz in 1903. It must be remembered that most preretinal hemorrhages are situated between the internal limiting membrane and the nerve fiber layer. The macular area spared by the hemorrhage may give the impression of a hole in the middle of the hemorrhage.

HEMORRHAGES OF THE YOUNG.—A thoro study of recurrent hemorrhages into the retina and vitreous of young persons, based on 110 cases collected from the literature including his own five cases, is given by **Finnoff.** The cases are arranged in tables according to sex, age and time of onset, etiology, first eye involved, and involvement of second eye. Of his own, Cases 1 and 3 are already contained in the literature as Cases 1 and 3 of Jackson and Finnoff (Y. B. 16, p. 172).

Case 2, a man, aged 42, with pulmonary tuberculosis three years before and sudden blurring of vision one year before, which gradually improved, again found his vision suddenly clouded. The right vitreous was uniformly hazy and contained small masses of blood, more numerous below. A hammock shaped subhyaloid hemorrhage, with its convexity downward, extended from the lower temporal to the lower nasal veins. The veins were uniformly distended and tortuous. A perivascular yellowish exudate covered a terminal branch of the upper temporal vein. Physical examination was negative but for a small cavity in the apex of the right lung. After a six months' stay in a sanitarium, general health and vision was reported improved.

Case 4. A man, aged 35, suddenly found his right eye hazy, and two weeks later its vision almost entirely lost. Vitreous was cloudy, due to presence of blood, and only the extreme nasal side of the fundus could be seen, where the upper nasal vein was distended and tortuous, not diminishing in size toward the periphery. In the peripheral portion, two veins were distended and tortuous; they were bordered by fine white exudate into which one vein disappeared. The accompanying artery was obscured by exudate; a small hemorrhage was found below it. Further to the periphery, numerous venous hemorrhages were seen. In the extreme periphery, the retina contained a silvery white exudate. The vessels were visible in this portion. In the lower part large subhyaloid and vitreous hemorrhages were seen. Physical examination was negative, but two apical abscesses were found and the teeth removed. No reaction was obtained after tuberculin. Subsequently vitreous cleared considerably and the disc could be seen. Vision increased from 0.08 to 0.6.

Case 5. The vision of both eyes of a man, aged 30, had failed suddenly about nine months before, while he was suffering from severe intestinal disturbances which had confined him to his bed for several weeks. Two weeks before examination, vision of the right eye suddenly failed. The right vitreous was filled with masses of blood which obscured all details. In the left eye, the vitreous was clear, except in the lower temporal quadrant, where a Y-shaped white veil of retinitis proliferans was found, extending forward for about 7 D., and obscuring the details of a branch of the lower temporal vein. All veins were slightly tortuous. The upper temporal vein was obscured for a short distance by thickened retina and scar tissue, about 5 d.d. from the disc. Beyond this point, the vein was convoluted near a round pigment mass. A thin vein entering the main vessel at this point was bordered in some places by white streak of scar, was tortuous in other places and received one small branch, which suddenly widened and appeared much thicker than the vein into which it emptied. Round patches of pigment were seen near the veins in the nasal fundus. Physical examination was negative and tuberculin produced no reaction. Ultimately the vitreous cleared decidedly. In this series of five cases of hemorrhages into the vitreous, the patients were all males, their ages ranging from 25 to 47 at the first attack; the right eye was first involved, and the greatest amount of destruction had taken place in it.

Cases 1, 2 and 3 were due to *tuberculosis*. In Case 4 there was focal infection from abscess of teeth and infected tonsils; in Case 5, *focal infection* from intestinal disturbance was considered a possibility. Conclusions derived are: Recurrent hemorrhages into the retina and vitreous in young persons is not a specific disease. Tuberculosis of the vessels, especially the veins, is one of the etiologic factors; the tubercular etiology must be proven by focal reaction and tuberculin injection, and the hygienic treatment will bring about improvement. Lues is an occasional, focal infection a possible cause; hemophilia might be a contributing factor. The hemorrhages are the result of a localized weakening of the vessels; increased blood pressure and exercise are only exciting causes. The veins are usually attacked. The retina is involved early in some cases. The disease is primarily in the retina, and the detachments are due to a traction from scar tissue. Prognosis is poor, both eyes usually becoming affected, and vision is markedly diminished. The disease is more frequent in men and is not so severe when occurring in women. The drawings of the details accompanying the paper testify to the close observation.

In the discussion, Holloway referred to cases from his clinic, in one of which focal infection was the underlying factor; he had at present three cases under observation with positive tuberculin test; tho the lesions are essentially peripheral, proliferative macular changes develop in some; delicate fenestrations of varying sizes and shapes and strands gradually develop. Wilmer distinguished two types, those in robust athletic young men and those of the socalled feminine type; in the latter he saw practically blindness in both eyes; most cases give positive tuberculin reaction; some had bad tonsils and constipation in addition; the last patient had positive tuberculin reaction and pancreatic disturbance; there may be a close relation between beginning puberty and disturbance of the endocrine organs. Friedenwald emphasized the importance of vascular changes in the finer vessels and the fact that the prognosis is not so bad.

Derby found these cases occurring later in life, and not due to cardiorenal disease and general changes in the vessels. His patient, a woman 51 years old, had lost the vision of each eye from repeated hemorrhages, and regained useful vision of one eye after five years. Knapp thought a tuberculous origin the most likely in these cases; the perivascular changes give rise to proliferation; as to the tuberculin test, there is probably a nonspecific reaction in a number of these cases. Davis found that a tuberculin test repeated after two months or longer will become positive. Langdon mentioned a case of massive hemorrhage and complete restoration of vision who, three days later, suffered complete detachment of the retina apparently from choroidal hemorrhage.

Bennett recommended the nonspecific action of salvarsan, mentioning the case of a young man, aged 22, treated this way, whose vitreous became clear within three months; patients with tuberculosis about the eye often respond better to salvarsan than to tuberculin, even without lues. Jackson pointed out that future statistics would show a larger proportion of cases from tuberculosis, and that a large proportion of these occur in women. Tubercular cases show perivascular lesions; those due to focal infection do not show lesions in the periphery.

Verhoeff did not think syphilis the cause in the cases under discussion, but he has observed proliferating retinitis and vitreous hemorrhages from syphilis. In these latter cases, the whole thing happens in a short time; two recent cases who had each received six doses of salvarsan developed an intense chorioretinitis with hemorrhages followed by proliferating retinitis; having seen many cases of chorioretinitis after salvarsan, he has entirely abandoned it. Parker thought it not right to conclude that a case doing well under tuberculin is necessarily tuberculous in origin; it is not necessary to show a lesion to be tuberculous before giving the foreign protein.

Finnoff thought the method of Davis would sensitize the patient and thus produce a false impression; tuberculin is no cure-all for tuberculosis, but some cases improve more than others; it might be the effect of the foreign protein; one must be cautious with tuberculin as a diagnostic and therapeutic agent; treatment is begun with 1/500,000 mgm.; if both eyes are involved the use of the tuberculin is not justified.

In the right eye of **McCaw's** patient, a man aged 40, who lost vision of the right eye, several small hemorrhages were found along a branch of the central artery which passed above the macula; one of these hemorrhages was old, the others recent. Vision improved, but at the end of the second week, the right eye had no vision and the vitreous showed a mass of hemorrhage. In the discussion, Stilwill mentioned a case of vitreous hemorrhage in a man of 40, in which the etiologic investigation was entirely negative. Matson emphasized that high blood pressure was not necessary for vitreous hemorrhage, citing his own vitreous hemorrhage in the left eye with a blood presure of 125 mm., and Finnoff thought these cases not so uncommon, and referred to his experience showing that tuberculosis is not the only etiology. (See above.) See also **Wolf** under juvenile angiopathy, and **Cords** under renal retinitis.

PROLIFERATING RETINITIS.—In the right eye of a healthy colored girl, aged 14, with normal vision and negative Wassermann, **Dupuy** found a veil like membrane attached to the center of the disc and extending about one and one-half mm. into the vitreous, attached to several of the larger vessels. Sweeping to the temporal region, it assumed a fan like form and contained collections of pigment. No vessels were seen in the structure, and its temporal end was so thin, that it could not be told whether it ended free in the vitreous or was attached to the retina. The lower artery made a loop of 1 mm. into the vitreous. The condition is interpreted as that of proliferating retinitis, and any relation to the hyaloid artery is ruled out.

The right eye of **Bell's** patient, with proliferating retinitis in both eyes, showed a shiny white mass in the temporal portion of the retina, from which a thin membrane passed back to the optic nerve and was attached to it. Numerous vessels could be seen projecting from this mass. Both discs were hazy because of vitreous opacities. The patient previously had Hodgkin's disease and was suffering from anemia.

In three brothers of a family of thirteen children, **McMullen** found fundus changes of different character, but all had one feature in common, viz.: abnormal connective tissue on the retina or in the vitreous. The cases are regarded as atypical proliferating retinitis following intraocular hemorrhage.

CHORIORETINITIS AFTER INJURY.—A grey-white, opaque, mammilated and somewhat club shaped mass was seen in front of and entirely hiding the left disc of the patient of **Danis,** a man aged 25, who had been injured by a stone 18 years before. Around the disc the fundus was somewhat excavated, and a circle of peripapillary choroiditis surrounded the disc. The condition presents all the characteristics of proliferating chorioretinitis as described by Lagrange as a result of war injuries. Retinitis proliferans was found by **Cross** in the left eye of a lieutenant, who had been struck in the left temple by a piece of shell.

TUBERCULOSIS.—For 20 years **Patterson** has been observing an anomalous distribution, multiplication and tortuosity of the retinal veins, and frequently the arteries as well, in patients with tuberculosis, even when not showing any marked shortness of breath. The case of a man, aged 50, is mentioned with low blood pressure, but low specific gravity of the urine and dense infiltration of a tuberculosis of former years, as shown by the X-ray, in whose fundi the vessels were greatly increased in numbers and tortuous, the small veins showing knotty kinks. Similar retinal peculiarities Patterson has noticed in the constipated and those with faulty elimination. Of 325 private cases with these fundus peculiarities, 13.23% are classed as possibly due to heredity; 36.31% were found in cases of tuberculosis, active or stayed; in 50.15% no cause could be obtained. See also **Eppenstein** under Pathology; and **Davis** under massive exudation.

POSTHEMORRHAGIC AMAUROSIS.—Visual disturbance after loss of blood was the subject of a symposium before the Paris Ophthalmological Society. **Terson,** opening the discussion, reminds us that about 250 cases are published, that this complication is comparatively rare, that hemorrhages of all sorts may cause them, and that usually three to eight days pass before the visual disturbances appear. These may appear as a quickly passing night blindness, as homonymous hemianopsia with permanent field defect and as reduced vision of all degrees, partly or entirely curable, at times incurable. The disturbances never came later than three weeks after the loss of blood. They appear in all ages, most frequently after the forties, and in women. The disc is pale, the arteries are narrow and at times there is an edema of the disc and the retina. Partial or total atrophy of the optic nerve and retina results.

The condition is a peripheral one, tho at times other symptoms indicate a more central affection (deafness, paralysis of eye muscles, etc.). While the clinical picture is quite well known, the pathology and the treatment need investigation. Comparative ophthalmology, general human pathology, animal and veterinary pathology, are to be considered in this connection. The different theories are then discussed. Ischemia alone does not cause the visual disturbances, since severe bleeding is so frequent, while the visual disturbances are comparatively rare, because unilateral cases have been reported and because of the late appearance of the visual disturbances. A toxemia may prepare the ground for the blindness. Certain serologic conditions may play a role, especially in the late appearance of the visual symptoms. The autopsies have shown ascending atrophy of the optic nerve of peripheral origin.

The treatment must prevent further bleeding, the head will have to be lowered, amyl nitrit, possibly adrenalin: after bleeding has ceased, patient must remain with head low and raised lower extremities, warm compresses to the eyes with repeated massaging of the eyes. Dionin instillations or subconjunctival injections to produce vasodilation. Iridectomy should not be practiced, but paracentesis of the cornea or sclerotomy may, by reducing the intraocular tension, reduce the ischemia in the retina; caffein stimulants, tranfusion, etc. Autohemotherapy, autoserotherapy and other procedures, such as lumbar puncture and fixation abscess ought to be studied in this connection. For the late manifestations subconjunctival injections, phosphorus, strychnin, fibrolysin, are recommended.

Bailliart declared that blindness following immediately after the hemorrhage can be explained by retinal ischemia; still, hemorrhage is, alone, not able to produce the visual symptoms; in the war injuries, with their great loss of blood, no eye symptoms have been noticed; an undetermined predisposing cause exists. Perrin reported two cases, one of blindness following two hours after a gastric hemorrhage, in which after intravenous serum applications, vision was partially restored; and a second case of blindness which came on four days after abundant nose bleeding, and healed after serum injection, with normal field and vision of 1/6. Cantonnet reported a case of blindness following hematemesis, which improved after serum injections, constricted field resulting.

Rochon-Duvigneaud spoke about the bleeding of horses by veterinarians, which at times leads to blindness for four or five days; the blindness in these cases is not only due to the bleeding but follows because the animal is sick. Terrien maintained that if ischemia were the only cause, blindness would have to come on immediately; a toxic factor must be assumed which allows the ischemia to injure the ganglion cells. Magitot thought the chemical and mechanical symptoms of the blood and of the circulation must be studied, together with the detailed physical condition of the patient; the head must be kept low, adrenalin must be avoided; heart tonics and serum injections. Jocqs could examine the field in three cases of hemorrhage within a few hours before the onset of the eye symptoms; all three got well; the field was constricted, especially for color. Abadie distinguished two forms of retinal ischemia; from vasoconstriction, and from compression of the artery by the edema of the tissues; we are probably dealing with the latter form in visual disturbances after hemorrhage. Brandes found visual disturbances come on after abundant hemorrhage in a patient who had previously had tobacco amblyopia. Dupuy-Dutemps believed that the ischemia of hemorrhage can only be a condition favoring the action on the retinal elements of a toxic or infectious agent of unknown nature.

Two cases of posthemorrhagic amaurosis are recorded by **Terrien.** In the one instance, a woman aged 30 years, primipara, complained of visual disturbances since her confinement four months before, when she had lost considerable blood for forty-eight hours. The lower part of the objects was not seen. Vision of the right eye was 1/4, that of the left 1/5. Discs were partially atrophic and well defined, the vessels were normal. The fields were contracted with almost complete absence of the lower halves. In the other instance, that of a German soldier, aged 24, who had been lying on the battle field for four days with a crushed left leg, the discs were somewhat indistinct 12 to 15 days after the injury; the vessels were dilated and the fields greatly contracted and almost entirely absent below. Gradually vision improved, some pupillary reaction returned, atrophy of the disc was quite marked, and the arteries were somewhat narrower.

Visual disturbances after loss of blood are rarely immediate, but come on most often several days later. In the cases examined early, the discs are hyperemic, slightly cloudy. The field is constricted, mostly in the lower half. The trouble is undoubtedly of retinal origin caused by the fall of the general blood pressure and that in the retinal arteries. The intraocular tension, only slightly decreased in spite of the diminished vascular pressure, is a factor interfering with the circulation in the smaller retinal vessels. Edema of the disc contributes to the impediment of the circulation; this way the late appearance of the symptoms might be explained. Posthemorrhagic blindness is rare after traumatism and more frequent in other forms, because of a possible factor of toxins in the other diseases. Ischemia of the upper parts of the retina is favored by the erect position, and this will explain the great defect in the lower field.

Ten days after a hemorrhage from a duodenal ulcer, a man, aged 57 years, the patient of **Goerlitz,** became totally blind. Discs were white and edematous with indistinct margins, and the retina was whitish opaque, while the vessels were thin and pale. After a few days the discs became better defined and vessels better filled. Both eyes were sunk in the orbit from the onset. After a few days death occurred. (See also p. 311 and p. 390.)

Hemorrhages from the digestive tract and the uterus are especially likely to bring about blindness, **Oyenard** declares. Different ophthalmoscopic conditions are found: Neuritis, edema of the disc, ischemia. In one-half of the cases, atrophy of the disc follows.

Quinin Blindness.—The term quinin amarosis should not be used, because there are undoubted fundus changes to be found, say **Rathery** and **Cambessedes.** The visible symptoms found, the constriction of the field with good central vision, are different from those found in other intoxications, such as that of alcohol, etc., which are characterized by a central scotoma with normal field limits. In quinin poisoning changes in the fundus appear rapidly, and late in other instances. (See also p. 365.)

Ten hours after taking 6 grams of quinin in order to produce an abortion, a woman, aged 27 years, the patient of **Giraud** became deaf and blind. Vision began to return four days later and was normal after ten more days. The field for white was contracted above and below, colors were perceived only in the center. The discs appeared white, the retinal arteries were contracted and showed periarteritis. A symptom not described until now consisted in one or two small yellowish spots above the macula. In the discussion, Marc Landolt mentions a case of Druault and Coulomb with yellow degeneration.

Relating 6 cases of visual disturbances after acute alcohol poisoning, presumably wood alcohol, and one of quinin poisoning, **Ischreyt** dwells on the different forms of the amblyopia caused by the two poisons; the central scotoma in the wood alcohol amblyopia and the peripheral constriction of the field in the quinin poisoning; the normal fundus in the beginning of the wood alcohol poisoning, the contraction of the vessels, the pallor and opacity of the retina in quinin poisoning. A central scotoma can be caused by an affection of the papillomacular bundle, but also by changes in the macula. Birch-Hirschfeld's explanation, that death of ganglion cells all over the retina would show itself first in the macula as a central scotoma, because of their greater number in that region, is very tempting, especially in view of the absence of any foci in the optic nerves of poisoned animals; still an isolated affection of the papillomacular bundle will explain the central scotoma easiest. The inferior hemianopsia found in one of his cases of alcohol poisoning would point to isolated foci in both optic nerves, or to a single focus in the upper half of the chiasm.

Because of the toxicity of optochin and eucupin, **Jess** undertook experiments on the rabbit, which proved that chinolin, a component part of quinin, is a strong poison for the eye. In the retina small round white spots were found with the ophthalmoscope, the vessels were dilated and the discs red. The foci would become absorbed after cessation of the medication and pigmentation would take their place, discs would become pale and vessels thin; the medullated nerve fibers, normal to the retina of the rabbit, would show symptoms of breaking down. After long continued poisoning with the drug, small crystals were found in the retina. Histologically the retina was adherent to the choroid, and vacuoles were found in the nerve and ganglion fiber layers, producing a bulging of the inner surface towards the vitreous. The symptoms greatly resembled those of naphthalin poisoning, but naphthalin is much less poisonous. No lens changes could be produced by chinolin. From trypaflavin and argoflavin, Jess could find no ophthalmoscopic changes in animals; histologic examinations are to be undertaken. All chemotherapeutic drugs should be tried out first under ophthalmoscopic supervision on the animal, and their use on man must proceed cautiously, while vision, field, color sense and dark adaptation are being watched.

Experimenting on himself, **Hess** noticed one hour after the instillation of 2% solutions of pilocarpin or eserin, a marked reduction of vision. In the center of the field, a dirty yellowish spot was visible; on looking towards the sky, a number of irregularly arranged dark spots appeared. This figure appeared bright on a dark background at the first moment when looking into the dark. A fine dark line on a bright background appeared indistinct and broadened at the point of fixation. Moving of a stenopaic hole in front of the eye made the normal vessels around the fovea appear indistinct, even invisible. In the normal chagrination of the fovea, a closely packed mass of dark globules appeared. These symptoms disappeared after 1 1/2 to 2 hours, came later and lasted less long after weaker miotic solutions. The size of the pupil has no share in these symptoms, and they are looked upon as the direct poisonous effect on the middle retinal layers by the miotic: either a spasm of the smaller retinal vessels or direct damage of the retina.

FUNDUS IN MORBUS WERLHOFII.—The fundi of the 43 year old man with morbus maculosus werlhofii, the patient of **Ischreyt**, were remarkably light, and at the posterior pole the right fundus was somewhat veiled, and contained in the fovea a small, yellowish, darkly bordered focus. In the left, the veiling was greater and more extensive, decreasing towards the periphery; near a small branch of the superior temporal artery, close the disc, was seen an elongated bright red hemorrhage, and in the fovea a yellowish focus. Ultimately, the right macula appeared like a dark shadow with yellowish spots, and the left one with round, yellowish spots and a black central dot; no central scotomas. **Leber's** views as to the cause of these hemorrhages is accepted, that small colonies of dying bacteria become attached to the vessel wall and damage it by their toxins.

FUNDUS IN CHLOROMA.—The retinal changes in the case of chloroma reported by **Sidler-Huguenin** were of the kind as found in leukemia. A healthy man, aged 30 years, suddenly began bleeding from the gums; scurvy was suspected. Striped hemorrhages covered the discs and accompanied the vessels into the periphery; some hemorrhages were round, puddle like; some of the vessels were accompanied by white lines; in the lower periphery of each eye, the retina appeared whitish-grey with a greenish tint. After three weeks death occurred. Autopsy showed the typical green discoloration of the marrow in the femurs and ribs. (See under Pathology, p. 326.)

CHOLESTEATOMA.—In their patient, aged 6 years, whose mother had noticed a peculiar reflex in the left eye for several years, **Offret** and **Pascano** found a tumor in the interior of the eye projecting almost up to the lens. The retina appeared greyish and the tension was normal. About a month later, the tumor appeared yellowish grey and very vascular in the lower temporal part, and more greyish and projecting into the vitreous in the upper nasal portion. The right eye was entirely normal. (See under Cholesteatoma, under Pathology, p. 311.)

CHORIORETINITIS JUXTAPAPILLARIS.—In the case of chorioretinitis juxtapapillaris reported by **Bane**, the patient, a boy aged 16 years, noticed the blurred vision of his right eye only the day before. V. 5/60. There was a marked retinitis extending beyond the disc. The urine contained a trace of albumin. Two weeks later, the swelling of the disc was more marked, the media were somewhat hazy and there was a disc size grey swelling at the macula, with a dark spot in the center. Later, the macular lesion consisted of an oval blue grey membrane with notched edges and smaller than the disc, situated to the temporal side of the fovea. A ring of pigment deposits had formed on the anterior capsule.

Every condition leading to a choroidoretinitis can produce the typical picture of retinochoroiditis (Jensen), and this disease represents therefore no separate clinical entity as far as etiology is concerned, **Koehne** declares. His case is to prove this. A woman, aged 24, with negative physical condition, complained of blurred vision in the right eye since the grip, two months before. Vision was 2/3; the vitreous contained dust like opacities, and the disc appeared covered by a dense white exudate. Below and to the nasal side of the disc was a 1.5 d.d. oval, prominent white focus like a tuft of cotton. Above this focus were four pigment accumulations, situated on each side of a horizontally running vessel. Subsequently, the infiltration became less prominent and the disc edges more clear. The field showed a sector like defect with the point of the sector at the blind spot. If every case of isolated affection of the choroid and retina were carefully examined perimetrically, the large number of retinochoroiditis cases thus found would soon prove that no special etiology of the disease exists.

A woman, aged 24, the patient of **Zeeman**, treated with neosalvarsan and mercury because of her lues, developed retinochoroiditis (Jensen) of the right eye, with a large macular scotoma extending to the blind spot; the condition improved after bichlorid injections. The author considers the condition as a neuritis retinae; and shows a correspondence between the adaptation curve and the changes in the visual field. It is important to know the field in each examination of dark adaptation. According as the central or peripheral portions of the optic apparatus are affected, the initial or end sensibility will have suffered in a different manner, which will manifest itself in the adaptation curve.

EXUDATIVE RETINITIS. — The two cases of *Coats' disease* reported by **Davis** represent two types of massive exudation into the retina. 1. With extensive vascular changes. 2. Without vascular changes. Case 1. In the right eye of a boy, aged 10, the fundus showed a large mass of white exudate, yellowish in spots, extending from the temporal half of the disc, upon which it encroached, to the extreme temporal periphery; the highest point measured 8 D. There were numerous hemorrhages near the macula; some of the vessels were fusiform. Numerous cholesterin crystals were scattered thruout the mass, especially at the lower and upper margins of the exudate. Several round pigment masses were also present. Light streak was absent on the vessels which ran over the mass. One of the retinal vessels was veiled over a short distance in the lower portion of the mass. Tuberculin injection produced local, focal and general reaction. Under tuberculin treatment, which was interrupted by occurrence of retinal hemorrhages following the Schick test at school, the patient gained 8 pounds and the mass and hemorrhages were subsiding.

Case 2. In the right eye of a girl, aged 19, the temporal half of the fundus showed a whitish yellowish mass, elevated about 2 D., extending from near the disc to the periphery, and about 3 d.d. wide at its widest point near the macula. Vessels were normal excepting for complete absence of the light streak on the vessels that ran over the mass. No hemorrhages; no cholesterin. Wassermann was negative. Case could not be followed up. The absence of the light streak in both cases is explained as due to refraction and not to reflection, a point emphasized by the author and by Loring years ago.

In a girl, aged 15, who had suffered from interstitial keratitis, **Hepburn** found the whole fundus in each eye occupied by white exudate, most marked near the disc and in the macula. In the periphery the exudate was not so dense, and there was a certain amount of pigment, but no definnite pigment proliferation. The discs were well defined. The case is considered one of massive exudate beneath the retina.

In a young man, 19 years old, with progressive myopia since childhood, who some time before showed iritis, pupillary membrane and a big staphyloma at the upper limbus of the right eye, **Lemoine, Opin** and **Valois** found in the left eye a condition resembling that of tubercular choroiditis, with partial retinal detachment and proliferating retinitis. The left eye also developed a staphyloma similar to that in the right eye.

Retinitis exudativa externa has only rarely been observed and examined in the early stages. The case of **Rados** is, therefore, of importance. It concerns the left eye of a girl, 1½ years old, with convergent strabismus. At the posterior pole, whitish masses crossed by the retinal vessels were found; no inflammatory symptoms and no hemorrhages were observed. Because of the growth of the tumor and the fear of glioma, the eye was enucleated. Histologic examination proved the disease to have been exudative retinitis, Coats, in a very early stage. The most important changes were: 1. Extensive vascular changes of various degrees mostly affecting the smaller vessels, obliterating them in places; proliferation of the endothelial cells and changes of the adventitial cells could be observed. 2. Serofibrinous infiltration of the retina and deposit of exudate in the inner layers and on the outer surface of the retina. 3. Formation of a vascular and cellular layer containing pigment epithelial cells, lying between and connecting choroid and retina. In the early stages of this disease, the retina shows vascular changes and progressive disturbances of nutrition. In the later stages, regressive disturbances of nutrition predominate, associated with the manifestations which cannot be considered as belonging to the primary symptoms of the inflammation.

Reviewing the literature of retinitis exudativa externa, **Demaria** reports 3 cases of the disease. 1. Secondary glaucoma with yellowish detached and thickened retina in the eye of a three year old child. Histologically were found: fibrinous exudate in the outer layers of the retina, small hemorrhages, cholesterin in the retina and in the subretinal fluid, foreign body giant cells. 2. Large white foci were found in the retina of a six year old child with heredity lues. The foci did not seem to be thick, vessels were normal;

the disease progressed in spite of antiluetic treatment. 3. In the eye of a six year old child were seen one large white focus in the macula and two small ones near the disc; in addition numerous small white spots.

In a man, aged 53 years, who a few months before had normal vision, **Zentmayer** found central exudative retinitis in the left eye. The disturbance began with metamorphopsia and halos. In the right eye, a group of greyish white irregular lesions, of the diameter of small vessels, formed in the macular region an area two-thirds of the disc and were arranged in a rosette. In the left eye, a four disc diameter large exudation was found in the macula, with an elevation of about 1 mm. At the margin of the exudation a hemorrhage was seen. The condition of the right eye was considered as a hyalin degeneration because of the normal vision. The cause of the changes in the left eye were undetermined.

When demonstrating his patient with exudative retinitis, **Meyling** dwelt on the clinically great similarity with the case of angiomatosis demonstrated by him.

In a youth of 18, vision of whose right eye had been failing for three years, **Hata** found cobalt bluish appearance of the retina with numerous whitish-grey and yellowish spots of different forms and sizes. In the periphery, uniformly grey-white opaque mass was everywhere present. In different places, miliary ***aneurysms*** were seen occasionally grouped like grapes or like pearls; in addition large and small hemorrhages were seen. Detachment followed by glaucoma ultimately necessitated enucleation. (See under Pathology.)

FUNDUS IN ENCEPHALITIS.—In one-third of 40 cases of encephalitis, **Ferrari** found fundus and visual disturbances, some of which are mentioned in detail: 1. A boy aged 16: ptosis, paresis right internal rectus, diminished pupillary reaction, discs blurred, greyish-red; veins dilated. Later, discs pale and arteries narrow; vision R. 1/4, L. 1/3. 2. 16 year old boy: ptosis, paresis right superior rectus, paresis of accommodation, discs hyperemic, edges slightly blurred, veins somewhat dilated. 3. 13 year old boy: ptosis, paresis left internal rectus, discs hyperemic, blurred; vision R. 1, L. 1/4; slight contraction of field. 4. 20 year old woman: ptosis, nystagmus when looking sideways, homonymous diplopia when looking to the right, heteronymous when looking to the left; greatly contracted fields; vision R. 1/3, L. 1/2. 5. A man, 19 years: ptosis, nystagmus, paresis right superior rectus and left external rectus; discs blurred; vision R. 1/4, L. 1/3; greatly contracted fields. 6. A boy, aged 16: paresis right external rectus, relative central scotoma for red, dyschromatopsia, discs hyperemic, veins dilated; later brief ptosis and pale discs. 7. 19 year old male: nystagmus, choked discs with good vision followed by improvement. 8. 17 year old boy: discs grey, edematous, veins congested. After five months, vision R. 1/3, L. 1/6; discs pale, not well defined. 9. Boy, aged 15: bilateral ptosis, paresis left internal rectus, choked discs with hemorrhages. Autopsy showed hyperemia of brain and meninges and internal hydrocephalus.

FUNDUS IN TRAUMATIC ASPHYXIA.—The case of a man, aged 47, who remained eight minutes pinned under a tunneling machine, gives **Berrisford** occasion to discuss thoroly the ophthalmoscopic findings in traumatic asphyxia. The eyes were proptosed, conjunctiva bulbi protruded between the lids and contained suggillations. Pupils were dilated and did not react. On the fourth day, the retinal veins in each eye were dilated and tortuous, and the discs were blurred, especially on the nasal sides. In the left fundus, two discrete, bluish-grey, elevated patches near the upper temporal quadrant of the disc were found. In the right fundus similar spots were scattered between the nerve and the macula; some distance from the disc, an elevated exudative area ensheathed the inferior temporal vein. No hemorrhages were found. Light perception was completely lost during the first 48 hours;

on the fifth day, fingers were counted at six feet, and vision was normal with normal fields six weeks later. This is explained by the assumption of a hematoma involving the optic nerves or sheaths. The bluish-grey, elevated areas were no doubt edematous swellings of the nerve fiber layers and were completely absorbed, so that the fundi were entirely normal nine months later.

Polycythemia.—In both eyes of a woman, aged 55, with polycythemia, the patient of **Trantas**, the discs were slightly elevated, the veins decidedly enlarged; several hemorrhagic and white patches were found in each fundus; some hemorrhages contained one or two white centers. This is said to be the first case of this disease with white patches. The patches disappeared after a few days, while new ones appeared in other places; they were independent of the hemorrhages.

Retinitis.—Retinal complications in consequence of *sinus affections* are little known, and **Gourfein-Welt** found only the cases of Bockaert, Wail and those of Siegrist reported at the Heidelberg meeting in 1920. Her own patient, a woman, aged 40 years, noticed several days after a painful treatment for her nose trouble, which was followed by severe headache and nose bleeding, greatly diminished vision of the left eye. First examination, six weeks after the onset, showed slight exophthalmus and divergence of the eye, with vision of fingers in 1 meter eccentrically and a central scotoma. The macula appeared surrounded by a ring of radial lines. The disc was normal. On the temporal side of the macula was a whitish focus; the lower temporal vein was greatly dilated and appeared veiled in the neighborhood of this focus; small hemorrhages existed between the macula and the vein. Nasal examination detected polypi in the ethmoidal sinuses and a purulent left ethmoiditis.

Nasal treatment was followed by rapid improvement of vision and diminution of the central scotoma. Three months later, vision was 1/6, the central scotoma had disappeared, but a paracentral scotoma was found on the nasal side, corresponding to the white focus on the temporal side of the macula. At this time the macula changes had greatly diminished, but the paramacular focus had increased, and hemorrhages had appeared in it. From then on the condition showed very little change. The eye condition is considered as due to the ethmoiditis, the veins from the ethmoid sinuses standing in direct communication with the ophthalmic veins; but it is difficult to explain why the macula was affected without any simultaneous lesion of the optic nerve or the disc. A retrograde thrombophlebitis is considered a possibility. The endonasal route of sinus operation contains danger, as pointed out by Siegrist, and a wide opening is advisable; cooperation between rhinologist and ophthalmologist is desirable.

In a 15 year old patient, who three weeks before had been suffering from *grip* with sleepiness, **Sallmann** found bilateral papilloretinitis with star figure. Elevation of the disc to about 2 or 3 D. Veins were enlarged; in the fovea small yellowish spots; around it, brilliant radial plaques forming the star figure. Because of the internist's diagnosis of *chloranemia,* it is questionable whether this pseudonephritic affection is due to the grip or to the severe chloranemia.

A case of bilateral *neuroretinitis* with star figure in the macula, *"retinitis stellata* (Leber)," following grip is reported by **Danco.** A boy, aged 13, with grip meningitis, complained of disturbed vision, especially of the left eye, during recovery. Bilateral diminishing optic neuritis was found, the discs being pale and edges indistinct; arteries were normal, but the veins were more tortuous and fuller; the marked star figure, especially above and below the macula, consisted of smaller and larger bright white foci; the macula itself was free and deep red. With red free light, the foci stood out well, and in the upper and lower periphery and especially on the nasal side, arched wreath like bright markings in the retina lying behind the vessels could be seen. An affection of the kidney could not be found. During the next months, vision became R. 5/36, L. 2/30, pigment accumulations appeared in the periphery, the wreath like markings and the star figure in the macula were broken up into small spots; the fields were contracted and colors could not be distinguished with certainty. Because of the defective color vision, an affection of the papillomacular bundle is assumed, together with an atrophy of the retinal fibers. Telescopic spectacles are useful in improving vision.

Chorioretinitis.—Marked chorioretinitis in the macular region and faint central opacity of the cornea were found by **Fagin** in the right eye of a young man, aged 16 years, with negative personal and family history and negative Wassermann reaction, but having typical Hutchinson teeth. In the discussion, Ellett thought the opacity one of healed interstitial keratitis, and said that we probably overlook the eyeground in cases of interstitial keratitis.

The vision of the left eye of a healthy woman, aged 28 years, having suddenly failed a few days before, **Koby** found in the macula a horizontally oval, yellowish focus, appearing like a gelatinous substance, which projected into the vitreous for about 3 D. It might also have been compared to a piece of cotton stained yellow. Two small hemorrhages were seen in its lower part; at the nasal and lower margins was an extensive hemorrhage, appearing grey. There were also two other smaller greyish patches. All around the focus were numerous fine radial reflexes, as an expression of fine folds of the superficial layers of the retina. Tension was 14, Schiötz. The retinal arterial pressure, measured by Bailliart, was slightly below normal, with normal general arterial pressure. Subconjunctival injection of sodium chlorid, iodid of potassium by mouth and later intravenous injections of cyanid of mercury were given. With red free light the yellow color of the focus was quite clear. Ultimately, an absolute central scotoma with normal peripheral field existed. In the right eye, which had appeared normal at the first examination, four little rounded yellowish spots on the temporal side of the macula appeared two days later. These spots became more distinct but paler, and never interfered with vision. Wassermann was negative. At the first glimpse, the focus could have suggested an intraocular parasite. The relation of the case to the existing clinical entities is discussed, and allusion is made to similar cases in the literature of yellow spots with yellow focus in the macula. (See Y.B., v. 17, p. 248, Weisenberg.)

The patient of **Wallace** with chorioretinitis, aged 24 years, a woman, already had poor vision in the right eye in 1913. In the right eye, alternating white and black patches on a greyish background extended on the temporal side of the disc for about 5 d.d., in a horizontal direction, and for about 1 1/2 d.d., vertically. In the left eye, large areas of atrophy were seen above and in the upper temporal field. In the discussion, Crisp suggested investigation for tuberculosis, *syphilis* or focal infection.

Seven years before, there occurred rapid loss of vision of the right eye of the 31 year old patient of **Fagin**, and vision of the left eye began to fail of late. In the right macula, a large white spot of destruction of choroid and retina could be seen; below and adjacent to it, another area of old chorioretinitis was present, also some around the disc. In the left macula, a small area of beginning chorioretinitis was the cause of the patient's complaint. (See **Fuchs**—Chorioretinitis—under Pathology.)

Neuroretinitis.—Vision and fundus of the left eye of **Magruder's** patient with neuroretinitis, a man aged 60 years, a heavy drinker with a history of many pulmonary and nasal hemorrhages, was normal for several days, tho he complained of a feeling of looking thru a veil. The right eye showed a very extensive old choroiditis. Vision of the left eye soon became 20/100, a definite blurring of the disc and two white areas appeared, while the veins were large and tortuous, with a few white patches near them. Antrum, ethmoids and sphenoids were affected, and four teeth were removed. Wassermann test and urine were negative. In the discussion, *focal infection* was suggested and the possibility of syphilis admitted.

Tho giving no subjective symptoms, the right eye of **Juler's** patient, a woman, aged 44, showed the following changes: the disc was blurred, white tissue was seen in the retina around the disc and in the vitreous, marked ensheathing of the veins by white tissue and pigment existed; fine changes at the macula and numerous yellowish dots in the temporal periphery; all as if the result of neuroretinitis in the past. Twenty-five years before, shallow central detachment had been found in the left eye, which was now invisible because of vitreous hemorrhage, visible by oblique illumination. Blood pressure was high and signs of chronic interstitial nephritis were present. Fisher suggested that the fundus changes might possibly be secondary to a *nephritis* from congenital *syphilis.*

Four weeks after exposure, a man, aged 24 years, the patient of **Oden** and **White**, developed after his fifth injection of *salvarsan,* blurred vision of the right eye. The disc was swollen 4 D., the retina around it cloudy, the arteries were small and the veins large and tortuous. Vision was 20/200; a central scotoma for red and green existed. The left eye was entirely normal. About five months later, the eye condition was unchanged. Wassermann remained negative from the beginning.

In the case of *erythema nodosum* complicated by neuroretinitis described by **Davis**, a woman, aged 30, with well marked erythema nodosum and otherwise negative physical findings, developed shortly after a tonsillectomy, bilateral severe uveitis. When the vitreous cleared enough to allow examination, both discs were found hazy and swollen one D., the retinas were edematous, the arteries small and the veins much engorged, and a white patch of exudate was seen in the left macula. Ultimately, the discs showed some atrophy, more marked in the left one, which also contained considerable exudate, while the retinas were somewhat edematous and vision was 2/3. The erythema had disappeared.

Retinitis of obscure origin in the right eye, in a man, aged 38, whose vision had been blurred four days, was found by **Hudson.** A faint edema was found up and in from the macula; later, small white spots appeared in this area with a central scotoma for colors, and the area became bounded below by a semicircular depigmented zone, with some excess of pigment below it.

ATROPHY OF RETINA.—**Castro** describes atrophy of the choroid and retina in the form of a large white circular ring, separated from the disc by normal fundus. Hemeralopia and consanguinity are the characteristics of this affection.

In both eyes of a woman, aged 45, who suddenly noticed a mist before the right eye two months before, **Doyne** found around the disc and about 1 d. d. away, numerous white spots, most numerous on the nasal side; their edges were crenated and they presented a spidery appearance. There was some indefinite pigmentation in each macula. In the right macula, there was in addition a recent hemorrhage, apparently the cause of the recent visual disturbance. Physical examination was negative.

TRAUMATIC ANGIOPATHY.—On the study of 3 cases thoroly observed shortly after the accident and during some time after, and after review of the literature, **Vogt** and **Knuesel** arrive at the following conclusion: The white foci are mainly situated on the temporal side of the disc, and above and below it along the main trunks; disc and macula are exempt. The foci are round, cloudy, at times confluent, of milk to silver-white color, and they lie on the inner surface of the retina, bulging the limitans interna forward. During absorption these foci show their composition of parallel dots and lines in the direction of the nerve fibers. The foci are an immediate consequence of trauma, since they could observe them already 20 hours after the injury; they are to be looked upon as the consequence of the sudden infiltration of lymph between the retinal elements. A transparent retinal edema could not be found in their cases. In 2 cases the macula had a greenish tint, and in one of these the macula appeared slightly yellow, even with ordinary illumination. The foveal reflex was absent in all, and the macula contained shiny spots and lines.

In all cases, a crescentic scotoma around the fixation point was found; adaptation was diminished. Absence of the foveal reflex, possibly due to edema, explains the diminished central vision. The prognosis as to perfect vision is therefore doubtful. The hemorrhages, found to be between the limitans interna and the nerve fiber layers, were often hidden by whitish foci, and only appeared with the beginning absorption of the latter. Hemorrhages and foci are therefore due to the same cause, the sudden increase of the intracranial pressure; the hemorrhages may have produced breaks in the perivascular lymph spaces. The cases are at times unilateral. The condition is not identical with Berlin's opacity; it is not the result of a contusion of the eyeball, but follows injury to the head. Berlin's opacity is uniform, white and disappears after hours or a few days; it is not superficial. Excellent drawings illustrating the different stages greatly aid in elucidating the paper.

To the nine cases of traumatic angiopathy of the retina found on record, **Vega** adds another one. No hemorrhage and no fracture of the skull were present in his case.

COMMOTIO RETINAE.—In the right eye of a boy, aged 15, who received a blow from a rope, **Williamson** found extreme edema of the retina; the macula was reddish brown, and there were two horizontal folds in the retina. Williamson questioned whether the concussion alone could account for all the edema, and he hoped that further observation would clear up some of the obscure features. In the discussion, Lawford commented on the folding of the retina. Leslie Paton said that at first the condition presented almost the typical picture of embolism of the central artery, and it was still likely there might be blockage of a vessel, the result of the concussion; there might be a tearing of a nerve which affected a vessel, and the hémorrhage had not come forward. Mackay agreed with Paton's suggestions.

SYPHILIS.—During two months in Bosnia, **Blatt** had occasion to study 12 cases of retinochoroidal and vascular changes of undoubted luetic origin, and 10 cases with similar symptoms but with doubtful luetic basis. The first mentioned 12 cases are the basis of his paper, and in all of them the fundus changes appeared late after the infection. The oldest patient was 49, the youngest 25 years old. With few exceptions, all had symptoms of a former inflammation of the iris and ciliary body. Dust like and larger vitreous opacities were found in all cases. In nearly all cases, the retina and choroid were affected together. The fundus changes were remarkable by the vascular changes of the choroid and retina, showing as sclerosis of the vessel walls, principally the arteries; this lead, in one case, to complete occlusion of an artery and, in another one, of a vein, producing the pictures of embolism and thrombosis respectively. Connective tissue proliferations dominated the ophthalmoscopic picture; they covered the retinochoroidal foci, extended onto the retinal surface thru openings in the lamina vitrea, or accompanied the vessels as white lines. The connective tissue characteristics might be of differential diagnostic importance, and the cases might be designated as "Retinochoroiditis fibrosa luetica." The absence of luetic nerve affections, and the appearance of fundus changes as a late luetic manifestation are contrasted with the clinical experiences of Central Europe. Detailed description of the cases, field charts and fundus drawings complete the paper.

About one year after the primary sore, the patient of **Harding,** aged 24 years, developed disturbance of vision, following the fourteenth injection of salvarsan, and rapid failing of it after the seventeenth injection. V. R. E. 3/60, L. E. 1/60. In the right eye, the vitreous was hazy, the papilla somewhat swollen and slightly cloudy, with indistinct outline. Of the left fundus, only an indistinct view could be had, and that only in spots, because of the great vitreous opacity. Rapid improvement of the vision and of the vitreous followed; but after the eighteenth injection, slight diminution of vision again developed, and after the nineteenth injection, marked loss of vision of each eye and frequent attacks of dizziness. The injections were now discontinued, improvement in vision and condition of vitreous slowly developed and became more rapid after mercury inhalations, so that ultimately no vitreous opacity could be detected, and the fundus became perfectly clear, but the discs appeared paler. The conclusion arrived at is, that the process is one of anaphylaxis of the system, both to the drug and the toxins liberated by it in the eye.

In a negress, aged 28 years, who had indefinite complaints about the left eye for five years, **McCaw** found the nasal half of the disc covered with a dull greyish membrane, which extended into the retina for one-half d.d., protruded for about 4 or 5 D., and presented the appearance of retinitis proliferans. Extending from the disc down and to the nasal periphery, was a greyish thin band, apparently an obliterated artery. Numerous deeply pigmented patches of grey exudate were seen near the vessels. Syphilis was considered as the underlying cause.

Two cases of *circumpapillary retinitis* were observed by **Oyenard.** In the one case, an Argll Robertson pupil was present in addition. Intensive antiluetic treatment was instituted, and after repeated relapses the condition finally healed, leaving a white ring around the disc. Of the second case, two colored drawings by Soriano are given, but the details of the course of the disease are lacking.

The case of bilateral syphilitic circumpapillary chorioretinitis in **Knapp's** patient, a Japanese aged 26 years, is remarkable for the detachment which was cured by the antisyphilitic treatment. Vision suddenly started to fail nine days before; each field showed a defect in the upper half and a central scotoma. The tension of the right eye was 12 (Schiötz), that of the left 10. The discs were blurred, illdefined, the fundi appeared greenish white well into the periphery, and the retina around the disc was swollen 2 D. A detachment was present in each lower fundus. Wassermann was strongly positive; mercurial inunctions, calomel by mouth and neosalvarsan were given. Later, a few hemorrhages appeared in the right eye, and the detachments increased in extent. Gradually, the retina became more pink, the detachment smaller and flatter and the greenish color of the retina disappeared. Finally, vision was 20/30 with each eye, and the fundi showed results of diffuse chorioretinitis and no detachment. As to the detachment, the opinion is ventured that the violent inflammation, having led to affection of the ciliary body and thereby to diminished tension, provoked transudation from the vitreous and exudation from the choroidal vessels, producing the detachment.

PREGNANCY.—Enumeration of the ocular changes of pregnancy by **Black** is followed by a more detailed discussion of retinitis of pregnancy. Retinitis of pregnancy is not an albuminuric retinitis, nor is it a true inflammation, but it is dependent upon a toxemia produced by the syncitiotoxins. It is not the formation but the failure of proper elimination of the toxins which acts deleteriously. The ophthalmoscopic signs are those of neuroretinitis with exudation and hemorrhage. If appearing in the first six months, pregnancy should be terminated to save sight; subsequent pregnancy may make the serious eye affection worse. Vision improves after delivery. Prognosis as to sight is less good than commonly thought. As to life it is better than in ordinary nephritis. Papilledema found during pregnancy may be due to pressure on the nerve by the swollen hypophysis. Detachment of the retina is found more frequent with retinitis of pregnancy than in nephritic retinitis. Reattachment has been observed.

Embolisms of the central artery have been reported. In three cases of retinitis of pregnancy observed by **Black**, infectious processes were found in the teeth and tonsils, and he therefore urges in addition to the examination for albuminuria a search for possible foci in the teeth, sinuses and tonsils.

Of 169 women with pregnancy retinitis, **Coutela** finds that 19 died, while 20 were left blind. In the 63 cases in which the fate of the child is known, only 26 were born alive and 14 died soon after birth. These facts, he says, "confirm the dictum of the Americans that the pregnancy must be interrupted in cases of albuminuric neuroretinitis." In the last months of pregnancy, he believes, it might be advisable to wait until vision drops below 1/6, in the hope of obtaining a living child.

The patient of **Valude** and **Lavat** showed, during the fifth month of her third pregnancy, severe general symptoms combined with retinitis and almost complete loss of vision; induced abortion produced rapid improvement, only slight general symptoms and retinal changes with slightly reduced vision resulting. During the fifth month of an otherwise normal pregnancy, the patient of **Couvelaire** and **Morax** developed visual disturbance and bilateral retinitis; interruption of the pregnancy was proposed but declined. In the eighth month, spontaneous expulsion of a macerated fetus was followed by rapid general improvement and complete cure of the retinitis.

As a sequel to his case report of retinitis in pregnancy, (Y.B. 16, p. 177) **Pocock** relates that an operation became necessary on his patient, and that the left kidney was exposed and found covered with cysts, a congenital cystic kidney. The case is interpreted that as long as the patient was not pregnant there was no albuminuria, but that the kidney became incapable of combating the condition when the extra strain of the toxin from the fetus was added.

With constant reference to the literature of the subject, in his extensive monograph, **Schioetz** analyzes his observations on *retinitis gravidarum* and *amaurosis eclamptica* in the Christiana Clinic. During five years, 680 patients were examined; 158 cases of eclampsia occurred during that time, not all of which could be examined ophthalmoscopically. Eye examinations were made on all patients with subjective disturbances, on those with pregnancy toxicosis and on most patients who showed more than the ordinary confinement albumin. Among his patients with no albumin and no symptoms of intoxication, were found: two cases of hemorrhage into the vitreous, one of embolism of a branch of the central artery, one recrudescence of old chorioretinitis, one of keratitis superficialis, one of keratitis disciformis, two of detachment in excessive myopia, three with old fundus changes, one of transitory myopia during pregnancy and two of retrobulbar neuritis in hyperemesis gravidarum.

Forty cases of *pregnancy retinitis* were observed; of these 10 had chronic nephritis before and after the pregnancy; 17 were healthy before, but showed nephritis after the pregnancy; 6 were free of symptoms before and after pregnancy, and in 7 the follow-up examination was missing, or the retinitis was not healed at the time of the report. In each one of these groups, the essential features of each case are given. Retinitis was found 16 times in primiparæ, 24 times in multiparæ. The retinitis usually began in the second half of the pregnancy. All stages of the development of the retinitis can be studied; even severe changes can disappear without any trace. Most of the time, silvery spots remain near the disc or near a pathologically enlarged, highly shiny foveal reflex. The macula was often brownish-red, large, polygonal or star shaped.

Darker or less dark areas result, in consequence of the accompanying choroidal affection. In the areas of formerly detached retina, pigment spots were seen. The typical star figure is followed by a more marked macula, white dots or pigment spots. Star figure was present twelve times; it developed after the retinitis changes, and at times while the retinitis was receding. The discs became somewhat atrophic; vascular changes were entirely absent or not marked. Retinal hemorrhages were not rare, they were mostly small and few; only in one patient with eclampsia and without retinitis did the retina contain many small hemorrhages. The subjective symptoms of retinitis are: dazzling, fogginess and disturbance of vision; vision decreases gradually in the last months of pregnancy. The greatest loss of vision is due to complications and especially to detachment.

Not a single case of recurrence of the retinitis was observed. Not one of the 40 cases of retinitis showed remnants of a former retinitis, but residuæ of old retinitis were found in healthy women. Of the 40 cases, 14 had, in follow-up examinations, normal vision; all others, with the exception of one who was totally blind, had vision sufficient for work and reading. This good vision is due to the active treatment, especially to the induction of labor. Most patients had nephritic symptoms before the pregnancy, while some seemed to have developed a chronic nephritis in consequence of the pregnancy kidney. In six cases a pure pregnancy kidney seemed to have existed, the patients having no symptoms before or after the pregnancy; four of these patients subsequently became pregnant again.

The retinitis is not based on a hyperazotemia. In 17 cases the blood pressure was measured; from the blood pressure alone no conclusions as to outlook prognosis quoad vitam could be drawn. The treatment is that of nephritis, and interruption of labor is of prime importance. Pregnancy must be interrupted, since one does not know whether the individual case is one of chronic nephritis or of pregnancy kidney; only with an older primipara is expectant treatment permissible, provided the eye symptoms are only slight and slowly increasing. In general, patients with pregnancy retinitis should be sterilized; renewed pregnancy may be permitted if the patient remains free of albumin and shows normal blood pressure for at least one year.

Eye symptoms with *eclampsia.* Of the 132 eclamptics and 26 patients with threatening eclampsia, 27 showed retinitis or papilloretinitis, 4 complicated with detachment; one showed hemorrhagic retinitis and three detachment without retinitis; in two patients, papillitis, in two edema of the retina, and in three chromatopsia was noticed. In all, 33% of the patients showed eye symptoms. During follow-up examination of 20 eclamptics, all were found perfectly well, free of albumin and with normal blood pressure. This contrasts greatly with the pregnancy retinitis cases; thirteen of these patients had subsequently become pregnant.

Among 8,400 cases of pregnancy, 14 patients with eclamptic *amaurosis* were observed and examined; in six of these vision returned so rapidly that no further examinations could be made. In addition, five other cases of eclamptic amaurosis and one of uremic amaurosis during confinement are considered. Six of these twenty cases could be examined with great accuracy. Of 7 patients with convulsions, four had perfectly normal fundi, one a moderate papillitis and retinal edema, and two were not examined ophthalmoscopically. In one patient a transitory homonymous hemianopsia was observed, during the disappearance of the amaurosis. One patient acted like a red-green blind on the day after the confinement. Of 6 patients without convulsions, one was red-green blind for more than a week, two were not examined ophthalmoscopically. The eclamptic amaurosis in patients with convulsions begins a few minutes or hours before the first convulsion, at times one or two days before; vision may return rapidly but may take two to four days.

In patients without convulsions and those with threatening eclampsia, the amaurosis runs a similar course, but there exists a better chance to examine the conditions; the visual disturbance lasted about twelve hours; it was not absolute; light perception existed. It is necessary to examine whether light projection or only central light perception exists. In two cases only central light perception existed. Four examinations should never be omitted: fundus, pupillary reaction, color sense and field. Fundus and pupillary reaction were normal. The transitory homonymous hemianopsia points to a central seat of the amaurosis, and the resemblance to the scintillating scotoma is pointed out. Increased cranial pressure must be assumed, and systematic examination of the spinal fluid should be made. Spinal puncture might be made to prevent an outbreak of the convulsions. The diagnosis, as a rule, is simple, but hysteric amaurosis and that due to anemia, retrobulbar neuritis and pathologic changes in the central nervous system must be considered. Prognosis as to sight is good; as to life it depends upon the general condition. The treatment is that of eclampsia.

ECLAMPSIA.—During the last ten years, **Lindgren** examined all patients with eclampsia admitted to the Aarhus (Denmark) Obstetrical Clinic, in all 134 cases. Of these, 58 had neither subjective nor objective symptoms; 62 showed positive subjective and negative objective conditions; 2 had no subjective complaints but showed positive objective findings, while 12 had positive complaints and positive objective symptoms; of these last three groups, cases are sketched. From this statistic, typical and atypical albuminuric retinitis were excluded. The changes found are classified thus: 1. Simple venous hyperemia of the disc up to pronounced papillitis; 2. Isolated focal affection of the retina in the form of white or yellowish white plaques near the disc which disappeared either entirely or leaving pigment changes; 3. Combination between forms 1 and 2, neuroretinitis; 4. Papillitis with retinal hemorrhage. All these 14 patients with objective symptoms left the institution with good vision because of the immediate delivery. The general intoxication, which forms the basis of eclampsia, leads at times to severe changes in the retina and optic nerve, which are always of a transitory nature; a true neuritis or neuroretinitis eclamptica exists therefore. It is of a better prognosis than the albuminuric neuroretinitis. A number of the newborn, the children of eclamptic mothers, examined showed no fundus changes.

DIABETIC RETINITIS.—Careful study of 44 cases of retinal disease observed in the Mayo Clinic in 300 cases of diabetes, leads **Wagener** and **Wilder** to the following conclusions: 1. Retinitis in uncomplicated cases of acute diabetes, diabetes gravis, does not occur. It was not present in 80 consecutive cases of this severe type. 2. Cases of diabetes with retinitis of diabetic type are always, or almost always, complicated by vascular or renal disease, and the diabetes tends to be mild and chronic. This was true in all of the 23 consecutive cases of this kind. 3. The primary cause of the retinitis of diabetes seems, therefore, to lie in the accompanying pathologic changes in the vascular system, the more essentially metabolic disturbances of the disease playing a second-

Benedict—Diabetes. (See under Angiosclerosis p. 324.)

In the case of *lipemia* of the retina reported by **Hardy,** of a man, aged 29 years, a complete metabolic study was made. The retinal vessels appeared as if filled with a greyish white emulsion of malted milk color, no exudates or hemorrhages were found. The color of the retinal vessels may be influenced by the retinal pigment and possibly by the source of light used for examination. The vessels in this case appeared flat, ribbonlike. Return to normal of the fundus ocurred during two weeks, due to energetic general treatment.

In a boy, aged 14 years, with diabetes, **Cohen** found both eyes hypotonic, the discs greyish, arteries and veins somewhat dilated, of approximately the same size and milky in appearance. Two small hemorrhages were seen in the left fundus. The total fat content of the blood was over ten times the normal, and cholesterol was about six times the normal. Since blood drawn from the arm of the patient was of chocolate color, Cohen explains the milky color of the retinal vessels, by assuming that the blood corpuscles held the center of the blood vessels, while the balance of the lumen was filled by the liquid containing plasma. That the choroidal vessels appeared more normal, he explains by the anatomic structure of the choroid and the extensive anastomoses of its vessels, these peculiarities preventing the blood corpuscles from keeping the center of the blood stream. In the discussion, Wolff mentioned a patient with diabetes whose retinal vessels had a pale purplish tint, the patient later developing lipemia.

Attention is drawn to the fact, by **Williamson,** that in certain rare instances, associated with a special blood condition, the retinal blood vessels, instead of having the normal deep red color, all appear milky white or pinkish white, while the rest of the fundus has the normal red color.

Massive exudation in both eyes was present in **Zentmayer's** patient, a man aged 50 years whose vision began to be smoky three months before. In the left eye, the exudation was surrounded by hemorrhages; in both eyes, more in the left one, the arteries were bordered by broad white stripes; the right temporal vein was thrombosed.

RENAL RETINITIS.—Discussing the latest views on kidney affections, **Gilbert** champions Volhard's views (see Hansen and Knack, Y.B. v. 17, p. 246) as to the explanation of albuminuric retinitis. Nephroscleroses can be accompanied by albuminuric retinitis but not the nephroses. The origin of the retinitis in kidney affections is not uniform. The same cause may attack kidney and retina, but the retinitis is secondary to kidney affection. The retinal changes found in kidney affections, not only present the typical picture of albuminuric retinitis, but occasionally that of a diffuse veiling of the disc, or of a circinate retinitis. Similarly, one must distinguish the affections of the retinal vessels which accompany but are not the consequence of nephrosclerosis; they are found in the malignant sclerosis (Volhard-Fahr), rarely in the benign form. There exists also the true nephritic retinal affections, which are probably a consequence of an affection of the glomeruli, which is essentially inflammatory in nature and not depending on circulatory disturbances.

Albuminuric retinitis has been claimed to be caused by insufficiency of the kidney function. Volhard declares that it can also appear without insufficiency of the kidney. A certain parallelism exists between the changes in the kidney and those of the retina. The retinal vessels are greatly contracted and the vessels in acute nephritis are greatly ischemic. In genuine hypertonia, the arteries are not taking part in the active contraction.

Reviewing the theories as to the origin of albuminuric retinitis, **Schieck** confirms the views of Volhard, that albuminuric retinitis is caused by an ischemia, which is not primarily due to vascular changes but to spasms. This same ischemia will produce an insufficiency in the kidney; this explanation agrees with the clinical and histologic experiences, and it also explains the many cases of macular star figure without kidney affection (Leber's retinitis stellata) found in conditions of lowered retinal nutrition.

The various signs and symptoms revealing in the retina the possibly otherwise unsuspected retention of nitrogenous waste are reviewed by **Terrien.** Treatment should be directed to the kidneys, a salt free, milk or vegetable diet with purges should be ordered, and lumbar puncture performed if headaches should be present. The eyes should be rested and tinted glasses worn; hot applications to the eyes and pilocarpin instillations if the tension is high; atropin should be used only exceptionally, for fear of hypertonia.

Discovery of albuminuric retinitis always carries with it a serious prognosis, **Genet** declares. White retinal exudate, often star shaped, in the macula, hemorrhages and edema of the disc, are the characteristics. It is especially frequent in nephritis with small kidney without edema. In albuminuric retinitis due to azotemic nephritis, death occurred during the first two years after the discovery of the retinitis. In nephritis with uremia, retinitis is much rarer and the prognosis is less serious. In acute nephritis of the scarlet fever type, the retinitis has a much less serious outlook and cure is possible. In retinitis of pregnancy, prognosis is less serious for the mother but is very serious for the fetus; in these cases pregnancy should be interrupted.

Albuminuric retinitis is of importance from the standpoint of differential diagnosis, but especially on account of the prognosis. Nephritis with retinitis shows four times as great a mortality, within six months, as nephritis without it. Of 177 cases of **Martin's** statistics, the final result could not be determined in 20; of the remaining 157 cases, the time of death was known in 142; the largest percentage of these died within the first year, and especially in the first months; after the seventh month, the mortality decreased rapidly and was even lower after two years. Five patients were still alive, 18, 15, 8, 6, and 5 years respectively after the appearance of retinitis. Death occurred sooner, the younger the individual. Percentage of cures and average life expectancy greater in women.

In seven of eighteen persons with albuminuric retinitis, and in eight of sixteen with chronic nephritis but without retinitis, **Gaudissart** found hyperchloresterinemia. The latter is therefore not an indispensable factor in albuminuric retinitis, and does not always necessarily produce it. But he found high blood pressure, or uremia, or both in albuminuric retinitis.

In his paper read during a symposium on nephritis, **Pfingst** emphasizes the frequency of retinal involvement in nephritis, especially in the chronic interstitial type, and holds that the frequent use of the ophthalmoscope in all cases in which kidney trouble is suspected should be encouraged, as well as a careful inspection of the retina of every presbyopic patient presenting himself for refraction. Early retinal changes are often visible in general arteriosclerosis and chronic nephritis before a kidney lesion would be revealed by the urine examination. Thru early detection of retinal changes and the institution of proper measures, the general condition of the patient may be improved, while in the well developed cases of retinitis an ophthalmoscopic examination is important because of the prognostic significance of nephritic retinitis both as regards life and ocular function.

In a general paper on albuminuric retinitis, **Crume** mentions the case of a man with failing vision, who had failed to get relief by glasses from opticians because of albuminuric retinitis, and had thus wasted his time and had arrived at the point beyond medical aid. Another patient, a man, who had similarly consulted opticians, etc., was suffering from Bright's disease and soon died. In nephritis, rapid loss of vision may occur with perfect pupillary reaction and accompanied by headaches, vomiting, etc., the cases being due to the brain being poisoned by excretory matters retained in the blood. Albuminuria in pregnancy may or may not be coexistent with retinitis; visual disturbance from albuminuria in pregnancy clears up usually; if chronic nephritis exists, prognosis is quite unfavorable. The case of a primipara is mentioned who one week before delivery was almost totally blind, and whose urine was loaded with albumin; vision began to improve three weeks after confinement and ultimately cleared up considerably. Another primipara developed albuminuria and failing vision, but miscarried at six months; in the third month of her pregnancy, twelve months later, vision began to fail and she again aborted at six months, becoming totally blind. The albuminuric retinitis and optic atrophy was still present two or three years later; the patient shortly died. In the discussion Hanna emphasizes that albuminuric retinitis in children is almost always secondary to tonsillitis, diphtheria or eruptive fevers. But most cases of retinitis are in individuals in late adult life; a number of sudden deaths or strokes are thus to be explained; eye disturbances as symptoms of constitutional disease should be emphasized.

In a clinical lecture on retinal hemorrhage, **Pepper** classifies the conditions, general and local, under which hemorrhages will be found in the retina, and presents the following case: A female, aged 51, had chronic glomerulonephritis and albuminuric retinitis, with hemorrhages, exudates and marked arteriosclerosis of the retinal vessels. In connection with this case a chart is given, showing all the symptoms of a group of recent cases of nephritis with their various symptoms, and it is pointed out that patients with very similar clinical findings had quite dissimilar retinal changes, and that little or no parallelism seems to exist between the retinal changes and any single alteration in the urine, blood or blood pressure. Not one of the nine cases of nonnephritis hypertension showed any retinal hemorrhages.

Decapsulation of the kidney on the patient of **Ewing**, a woman aged 28 years, comatose in consequence of parenchymatous nephritis, and having a swollen left disc with numerous hemorrhages in its neighborhood, lead to great improvement in the general condition of the patient two days later. Three weeks after the operation, each disc was swollen and each macula showed marked fatty degeneration. About three months later, the active fundus changes were gone, *retinochoroidal atrophy* having appeared with narrow central vessels and pale discs. Vision then was R. 20/48, L. 20/75. Subsequently the patient developed cerebral embolism and died about three years after the operation.

Of 17 eyes affected with albuminuric retinitis, **Heine** reports 15 favorably affected by subconjunctival injections of milk, the deterioration of vision being arrested; marked improvement of vision occurred 11 times.

In his paper on papillitis and glaucoma, **Cords** arrives at the conclusion, that only those cases of papillitis or choked disc can lead to glaucoma in which more or less extensive vascular changes exist; albuminuric retinitis and papillitis in juvenile phlebitis of the central retinal vein are among them. Albuminuric retinitis can produce absolute glaucoma of both eyes; changes in the vessel walls and obstruction in the central veins always exist. Juvenile phlebitis can produce the picture: 1, of papillitis or choked disc; 2, total or partial thrombosis of the vein, and 3, genuine atrophy of the optic nerve. See also **Weisfelt** and **Calhoun** under Detachment.

WAR NEPHRITIS.—Of 608 patients with war nephritis examined, **Horniker** gives conclusions from ophthalmoscopic findings in 571 cases. The larger part showed fundus changes, some being of very passing character. Edema was found on the nerve and in the retina, together with the pathologic retinal reflex lines; the small vessels in an edematous macula seem to disappear and reappear, and might be mistaken for hemorrhages. In one case of severe greyish edema of the retina, the patient complained of green vision for two days. In 67 cases, or 11.5%, hemorrhages were found, mostly in the macula and near the disc. *Hemorrhages* and retinitis were found in a large percentage of the cases with high blood pressure; the hemorrhages were linear, round or irregular. Preretinal hemorrhage was found in a patient whose other eye remained free of hemorrhages, but showed edema. The hemorrhages may be radial around the disc. They can be absorbed quickly or leave fine scars and pigmentations.

Retinitis was found in 76 patients, or 13%; of these 32 had acute, 35 chronic diffuse glomerulonephritis and 9 had malignant sclerosis; 43 of these cases had a mild form of retinitis with few moderately large, white, shiny or more dull, round or irregular spots in the macula, with occasional hemorrhages; 10 of the cases belonged to the degenerative form of Leber, characterized by small and fine, round or irregular whitish, greyish-white, closely placed dots behind the vessels, mostly in the papillomacular area, the condition resembling the changes seen in patients with arteriosclerosis; 19 of the cases were of the severe form and showed marked edema, redness and swelling of the disc, almost like choked disc; the white patches in the retina were extremely changeable. In 4 cases the retinitis was combined with choroiditic changes. In one of these cases, that of a man 32 years, development of angioid streaks could be observed. They appeared together with hemorrhages and can, therefore, not be due to hematogenous pigmentation of small preexisting retinal vessels; but they must be the result of migration and deposit of pigment epithelium in the walls of the choroidal vessels.

The retinal vessels were either normal or narrow; acute ischemia was found in two patients during the uremic attack; narrow vessels were found in most cases of a chronic glomerulonephritis and in all cases of chronic malignant sclerosis. Tortuosity of the small macular vessels was a very constant symptom; white lines along the vessels on the disc and in the retina were frequent, and their disappearance was often observed. The author believes that ischemia of the retinal vessels was existing in all cases of nephritis. That the retinitis in nephritis is more frequent compared with other ischemic conditions, is to be explained by the additional assumption of a toxemia, which can show its effect best because of the existing ischemia.

HEREDITARY DEGENERATION.—In a woman, aged 44, the offspring of blood relations, in whose family several members were affected with a similar disease, **Takagi** found a dirty light yellowish fundus with small dark grey spots. The retina was not opaque, and the vessels were normal, as were also the discs. Vision was 4/12, the light sense was reduced and the fields slightly contracted concentrically. Similar conditions were found in her sister and her first and third sons. The changes are assumed to be in the pigment epithelium.

In his sixth communication on the so-called *retinitis centralis,* **Masuda** reports his findngs in field examination. In 47.5% of these cases, the *scotoma* is regular; in 27% of syphilitic central retinitis it is irregular, and the borders are undulated, while the central part of the scotoma is often paracentral, thus giving rise to a crescentic scotoma.

According to **Itoh,** *beri-beri amblyopia* and central retinitis are frequent in Japan. Central scotoma is usually complained of, and the yellow sensation is mostly affected in central retinitis, while the green vision is first affected in beri-beri amblyopia. George Young's threshhold test (Y.B. v. 15, p. 139) was used.

A central scotoma is present both in beri-beri amblyopia and in retinitis centralis. But in retinitis centralis, **Oguchi** found the sensation for yellow diminished, and in the other disease that for green. It is assumed, that in retinitis centralis a slight exudate in the macula absorbs mainly the yellow color.

Four cases of *Oguchi's disease* are reported by **Sakai.** In one of his patients, Sakai shaded one-half of one eye and found the shaded half normal in appearance, while the unshaded portion showed the typical fundus changes. It is assumed that a condition prevails similar to the color changes of the skin of some animals.

RETINITIS PUNCTATA ALBESCENS AND PIGMENTOSA.—**Lievens** endeavors to show the relationship between pigmentary degeneration and retinitis punctata albescens. His patient was a man, aged 20 years, one of 16 children, of whom 7 were living, of non-consanguineous parents. An older brother, who had died, had suffered, as the patient, with poor vision and night blindness; no other member of the family had any eye trouble. In each fundus of the patient, the disc was faintly pink on the nasal portion and grayish-white, mixed with yellow, on the temporal portion (waxy). The fundus was dotted with innumerable white spots, which in appearance, but not in color, reminded one of the verrucæ of the choroid.

The spots never were in front of the retina, and with the direct method appeared the size of the head of a pin, with irregular, not sharply, defined borders. Towards the equator, the spots were closely packed together and confluent, forming large plaques. Small irregular spots of pigment were found in different places. In the periphery, pigment spots covered the retinal vessels. The arteries were one-half as wide as the veins. Here and there, brilliant calcareous or cholesterin crystals were seen. Reviewing similar cases from the literature, Lievens arrives at the conclusion that certain cases of retinitis punctata albescens form a transition towards pigmentary degeneration, just as cases of pigmentary degeneration are encountered with small white spots.

The manner in which *pigmentary degeneration* appears—now hereditary, now entirely isolated—can be explained, **Hansen** claims according to the experiences in experimental heredity. Pigmentary degeneration is based on a specific dominating factor, while in dementia precox a recessive specific factor is underlying. In retinitis pigmentosa, a local degeneration of certain peripheral nervous elements occurs, and the same happens in the cases of congenital deafness which are the hereditary equivalent of retinitis pigmentosa. In dementia precox, on the other hand, degeneration of certain central nervous elements occurs.

Pigmentary degeneration in several sisters observed by **Muecke** is traced to the manifold consanguinity of parents and other ancestors. The grandmother suffered from night blindness. A detailed family tree clearly explains the degree of inbreeding. Other members of the family showed a tendency to nervous eye affections. Another family of the same village contains five blind sisters and brothers.

In the case of *retinitis pigmentosa* presented by **Pockley,** vision was 5/60 without gross contraction of the field. The discs were dirty greyish. Both macular regions were encroached upon by the fundus changes. A large dark spot, at first believed to be a neoplasm, proved to have definite hemorrhagic edges. Wassermann was negative. In the discussion, Halliday said that the small size of the pigment was in favor of the diagnosis of retinitis pigmentosa. In the discussion of **Cross'** paper on fundus lesions in War, Chance mentions five or six cases of retinitis pigmentosa observed by him.

In the patient of **Blaxland,** aged 11 years, small patches of choroiditis, some taking the form of spider like particles, were seen following the course of the vessels and at the periphery; the discs were pale. The question was raised whether the case was to be classed as disseminated choroiditis, or as one of the pigmentary degeneration. The consensus of opinion was in favor of the latter, and trephining was suggested.

The case of pigmentary degeneration reported by **Suker** presents several interesting features. A man, aged 53 years, with no consanguinity in the family, 20/16 vision in each eye, and who never had seen well at night, showed the typical pigment spots in each eye in the nasal half of the retina, up to the median line, occupying the outer third of the periphery. The optic nerves and balance of the fundi were perfectly normal. The temporal field showed large, almost coalescing scotomas, a temporal hemianopsia. The form and color fields were restricted in the temporal field to about 35°, and to about 45° in the nasal field. Six years later, with unchanged vision, typical pigment spots were found in each temporal half, completing the circle of pigment spots. Slow contraction of the fields had taken place. Suker believes that in pigmentary degeneration some endocrin glands might be held responsible for a certain amount of changes.

In a little girl with pigmentary degeneration of the retina and marked *adiposity* due to an affection of the hypophysis, the patient of **Chaillous,** there was also present a supernumerary toe on the right foot. X-ray examination of the skull showed a normal sella turcica, but treatment with pituitary extract reduced the patient's weight by 3 kilos. Thyroidin was badly borne by the patient. Wassermann reaction was negative. At the age of ten and a half years, the patient developed Pott's disease. Chaillous' pupil Bardet, in publishing this case, collected other cases from the literature; reported by Bertolotti, De Cyon, Rozabel Farnes, Variot and Bouquier, J. Madigan and Thomas V. Moore.

The 38 years old patient of **Mohr,** with unilateral pigmentary degeneration, first noticed poor vision of the left eye in 1916, and the fundus presented a typical appearance, while the right eye was perfectly normal. The left field was typical, with concentric contraction and incomplete ring scotoma, while the right field was perfectly normal. In addition, unilateral night blindness existed. Etiologically, nothing could be found. Leber has found only 14 similar cases. (See **ten Doeschate** under Pathology.)

CIRCINATE RETINITIS.—Two cases of circinate retinitis are reported by **Lauber.** A tobacco worker, aged 55 years, with history of varicose veins, arteriosclerotic gangrene necessitating amputation of his left leg, and sugar in the urine, noticed failing vision for over a year. V. R. E. 6/24, L. E. fingers at 5 meters. Paracentral scotoma left eye; discs and vessels appeared normal. Numerous small, in places confluent, white spots were found around each macula, and a few also on the nasal side of the discs. At first fine linear hemorrhages were present in the fundi, together with dot like ones in the maculae. To the nasal side of the left macula, a strongly lustrous focus developed, by the confluence of several smaller spots; on this focus a white flocculent mass was then deposited. A woman, aged 64 years, with bilateral apical lung affection and war (hunger) edema, noticed diminished vision for three years. V. R. E. 6/18, L. E. fingers at 1/3 meter, Central absolute scotoma left eye; with numerous old pigmented choroiditic foci of similar origin as the lung condition and myopic fundus changes, there was found a crescent at the lower margin of the right disc. In each eye were thin but normal vessels. While only a few spots were found in the right eye, the left showed an almost complete ring around the macula, consisting of white, partly confluent spots, which formed a larger focus near the disc.

Almost identical symmetric changes in each fundus were found by **Yano** in a boy of 13 years. A circular or oval zone of white exudation, consisting of numerous large and small brilliant white spots and lines, lying behind the retinal vessels especially in the macula, extended from the macula to the nasal side of and enclosing the disc. V. R. E. = 0, L. E. = 0.1. Treatment with potassium iodid, mercury and saline injections had no effect. The case is looked upon as one of atypical circinate retinitis.

ANGIOID STREAKS.—Since the nature of the angioid streaks is not definitely settled, it is best to adopt the English appellation, which does not commit to any one theory, **Lederer** declares. The appearance of the streaks in the cases reported varies so much, that different processes might be assumed. That this is not so, is proven by his case of a woman, aged 41, with old pulmonary tuberculosis, who showed the usual thin streaks in the right fundus and very broad plump ones of a more brown-red color in the left eye. During observation, a small brownish streak in the right fundus became dark red and of the same color as the hemorrhage which had occurred. This change is explained to indicate that blood from the hemorrhage had entered into a preformed space, not a vessel, presented by that part of the streak. He cannot accept the views of Guist, and agrees with Fuchs that none of the explanations are really satisfactory. The etiology is still unsettled, but if hemorrhage plays any part, the viscosity and coagulability of the blood might be investigated.

Detailed description of the fundus condition in his case of angioid streaks in a healthy man, aged 45 years, is given by **Guist,** because of some features which might be of importance to understand the affection. Around the right disc was an incomplete wreath of tortuous, light grey-brown, indistinct streaks, of 1/4 to 1 vessel diameter thickness. On the temporal side of the disc, a white area in the fundus, bordered by angioid streaks, appeared like a tear. Several pigment streaks were seen going towards the periphery, some originating a short distance from the wreath around the disc. They were zigzag like, repeatedly interrupted, often branched and enclosing an island of fundus; the streaks varied in diameter. In addition, fine, short, in places spindle like lines, of similar color to the streaks, were found in an area of 4 to 5 d.d. around the disc. Most streaks were accompanied by white lines which did not change with the illumination.

In the macula was a 3 to 4 d.d. large opaque area, with hemorrhages at the edge, thru which streaks could be seen. On the temporal side of this area was some white connective tissue. With red free light, the impression of cystoid degeneration of the macula was had, and the white lines along the streaks appeared composed of fine, short, white lines perpendicular to the streaks. In the left eye similar conditions were found; the wreath around the disc was complete. In the macula was a 3 to 4 d.d. light yellowish-grey area with white lines of connective tissue and small hemorrhages. The condition in the right macula is considered an early stage of that in the left one. After an analysis of the literature, the author says:

Angioid streaks characterize a chronic affection, with degeneration of the pigment epithelium based on choroidal disease, most probably a flat choroidal detachment on an exudative basis. The condition seems to be inherited at times and concerns both eyes. The first symptoms of pigment migration are followed by formation of folds, which give the impression of pigment streaks. With the formation of connective tissue, these change their color and show white borders; shrinking produces tears in the epithelium and hemorrhages from the retinal vessels; finally retinitis follows, producing scar formation and diminished vision.

The angioid streaks in the eyes of a man, aged 45, observed by **Ascher**, showed marked differences in color. The darkest portions were the thinnest, while the broader streaks were more light brown or brownish-red up to red. Most of the streaks were lying in whitish-yellow and slate-grey colored areas of the retina. The thought, therefore, arose that these color differences were simply due to contrast, in such manner that the streaks appeared the more dark in the midst of the light fundus, the narrower they were. In another case, a similar symptom could be observed. Two other cases of angioid streaks are mentioned, one very slight one, and the other one in which the streaks gradually disappeared after two years.

FAMILIAL MACULAR DEGENERATION.—From the Jena Eye Clinic, **Becker** reported 12 cases of *bilateral* macular degeneration observed since 1910; seven of the cases occurred in three families and five were isolated instances. The macular lesion appeared as yellowish-reddish spots with slight pigmentation, or as dull greyish-red radial stripes; in other instances, again, greyish-yellow with fine or coarser pigmentation or greyish-white. Physical examination was negative, and the condition had begun in early childhood or as late as the twentieth year. Central vision was greatly reduced in all cases, and in all a central scotoma was present. All of his cases Becker classifies as belonging to the heredodegenerations of the macula (Behr), and he assumes a primary destruction of rods and cones. Treatment is without avail; telescopic spectacles might improve vision.

In 1905, Best reported familial macular changes in 8 members of a family. In 1919, **Vossius** had occasion to examine an 8 year old girl because of a slight injury, and found a bilateral macular, round, sharply defined, disc size, yellowish spot, with pigmented edge, with norml vision. It was soon discovered that the child was a member of the family reported by Best; and further investigations proved that repeated intermarriages had occurred and that a side branch of this family contained 6 cases with similar changes. The patients were individuals between 8 and 16 years. Reference is made to the works of Stargardt and Behr.

In a father and 3 of his 6 children, **Clausen** found peculiar bilateral hereditary macular changes, while the other three children had perfectly normal eyes. The father's father is supposed to have had a similar affection. These cases prove that the affection can, contrary to the opinion of Behr, be transmitted directly from father to the children. Clausen looks upon the cases as being of a recessive character, but the facts are too meager to allow exact classification of the inheritance. The red-green blindness found in his cases is looked upon as an acquired color blindness, which stands in direct relation to the degeneration of the macula. The cases were: 1. The father, aged 53, had good vision until his 41st year, when vision began to fail. In each macula typical small spots of tapetoretinal degeneration. 2. The daughter, 27 years old, with failing vision since her 23rd year. 3. A boy, aged 19 years, in addition to the macular changes, salt and pepper fundus changes were found with failing vision since the 10th year; in his right eye, below and to the temporal side of the disc and in the extreme periphery. 4. A girl of 15 years, with good vision until the 13th year.

In three boys and two girls belonging to a family of eight children, **Kleefeld** observed diminution of vision at the age of ten and a half, with central scotoma for red and green, accompanied by optic atrophy and *punctate retinitis,* most marked in the macular region. Wassermann reaction was negative.

Senile Macular Degeneration.—Typical changes in both eyes in a man, aged 78, could be studied histologically by **Behr.** No inflammatory process was found, but purely degenerative changes limited to the foveola and gradually giving way to normal retina. Edema bulged the inner nuclei forward. Degeneration was mostly in the outer layers, gradually decreasing inward and to the periphery. The foveolar hole was three times as large in the neuroepithelial layer as in the outer nuclear layer. No symptoms of repair were found. Pigment epithelium was normal. The conditions found in this case are almost identical with those in the case of Harms. The affection is not due to inflammation but purely to degeneration. It is a premature death of a certain group of cells based on defective germ predisposition (abiotrophy). Senile macular degeneration only forms a special type, of a general picture of the macular heredodegeneration, due to a congenital predisposition to premature death of the maculoretinal neuron. In the beginning the pigment epithelium is normal; later secondary changes may develop.

In the right macula of **Musy's** 15 year old patient, a round white disc, less than nerve size and surrounded by pigment accumulations in concentric rings, was found. The most central portion was brilliant white. In the nasal half, the brownish black pigment lumps appeared like bone corpuscles. No difference in level could be found. A superior and inferior macular artery each had to wind their way between the pigment lumps to the center of the white disc.

Macular Disease.—A better knowledge of diseases of the macula is desirable, declares **Batten.** Macular changes, frequently, are the only evidence of disease. Discrepancy exists between the ophthalmoscopic picture and the symptoms. With efficient light, fine pigment changes will be found in the macula which ordinarily escape detection. Finer changes can be seen better on looking on the side rather than at the macula. In the two acute cases which he showed, the changes were not unlike the family group. The family group should be kept in mind when investigating macular changes, otherwise the explanation of the changes might be missed. In his case, pyorrhea, suppuration of the nasal sinus, gonorrhea, influenza, pregnancy, etc., were at work.

In **Roll's** case of macular change presenting a circular plaque of what seemed to be organized fibrous tissue at the macula, the changes were symmetric in each eye. The appearance was not unlike that in the Tay-Sachs' cases: in one eye there was a hole thru the plaque of fibrous tissue. Sight had been failing for seven years. The fields for white and red were normal, but yellow and green were not perceived at all. The only traumatism in the history was proximity to a falling bomb. In the discussion, Herbert Fisher did not think there was any resemblance to Tay-Sachs disease, and Cruise mentioned a similar case observed by him for ten years, which had begun with an edema of the macula, a similar affection developing later in the other eye. At first a slight stippling of the macula was present, then edema and later a pale looking area developed, and that was now quite pigmented over, which would give the impression of a hematogenous origin; tuberculosis was a possibility. From two similar cases, since the war, dysentery bacillus and paratyphoid organisms were obtained; both improved with a vaccine.

A mass at the macula, of uncertain nature and origin, was present in a man shown by **Blair.** For 2 1/2 years there had been difficulty in seeing with that eye. In the discussion, Batten mentioned a case under his observation with a mass in the macula, which had followed scarlet fever and middle ear trouble; his and Blair's case he considered inflammatory. Fisher thought there was no inflammation; Mayou spoke of his patient with similar appearance, a girl 12 years old, with punctate keratitis and tubercular glands, as an evidence of inflammatory nature of his case, which he also claimed for Blair's case.

At the Ophthalmological Society meeting in Vienna, **Candian** demonstrated drawings of various macular affections as seen with ordinary and with red free light.

95 patients with *iritis* in 117 eyes were examined by **Lippmann** as to a *central scotoma.* In 35 of these cases, with 39 eyes, field defects were found which were often transitory. The author concludes, that, in the greater number of cases, the affection was in the retina, because of the prevalence of the disturbance of the blue-yellow sensation. The fovea is principally affected because the sensory epithelium here is almost directly in contact with the vitreous, which contains the toxins.

AMAUROTIC IDIOCY.—Thoro clinical and pathologic examination of a typical case of amaurotic idiocy, in a Jewish girl who died at the age of 19 months, is reported by **Marinesco.** Using newer methods of histologic examination, together with the older ones, he found the affected brain cells and some parts of the dendrites overloaded with lipoids. Oxydases were absent where lipoids were found. Glycogen was found within neuroglia cells and in the vessel walls, also in the protoplasm and in the nucleus of nerve cells of the cortex. Qualitative and quantitative changes found in the mitochondria are looked upon as of special importance, since the nuclei of the affected cells were usually intact.

The case of amaurotic family idiocy, demonstrated by **Valude** and **Lavat,** was that of a Roumanian Jewish child, 18 months old. Typical fundus lesions were found in both eyes, the patient being in an advanced stage of cerebral degeneration. This is the second case observed in France.

The typical case of amaurotic family idiocy reported by **Kearney** was that of a boy, 18 months old, affected since three months old, the fifth child of Jewish nonconsanguineous parents. The discs were extremely pale, vessels normal and a greyish white area, with a rose-colored spot in the center and furred edges, was seen in each macula, while the surrounding retina appeared muddled.

Typical amaurotic family idiocy, atrophic discs, white area in the macula with cherry red spot in the center, together with other general symptoms, **Appleman** found in his patient, a fifteen months old first born of Jewish nonconsanguineous parents.

JUVENILE AMAUROTIC IDIOCY.—In a girl, whose sister died at the age of 16 years of amaurotic idiocy, **Okayama** could observe the disease in its beginning. The patient was perfectly normal until 10 years old; then gradually sight began to fail; the discs were yellowish, pale, and the intellect weak. There developed convulsions, insomnia, irritability and imbecility. General paralysis came on, and the patient died from exhaustion in her fifteenth year. (See Bielschowski, under Pathology.)

CEREBRAL SCLEROSIS.—Correctly assuming that the clinical picture of "tuberous cerebral sclerosis" is unknown to most ophthalmologists, **van der Hoeve,** in reporting six cases of ocular changes observed by him in this disease, begins with a sketch of the clinical picture. The disease often begins in early childhood with epileptic attacks and disturbance in the psychic development. Imbecility and idiocy result, the condition leading to death, mostly about the twenty-fifth year. Somatic symptoms which make the diagnosis possible, are tumors of the kidney, heart, thyroid and especially of the skin. The first case in which ocular symptoms were discovered was that of a 17 year old girl suffering from tuberous cerebral sclerosis. She showed defective intellect, dizziness, epileptic attack, adenoma sebaceum and other skin affections, together with thyroid tumor. In the eyes, multiple, slightly elevated retinal tumors, with incrustations, and a growing tumor on the disc were found. The tumor showed cystic degeneration and many hemorrhages. Repeatedly, the cysts emptied into the vitreous, and hemorrhages in the vitreous from the tumors were observed. Pieces of the tumor were seen in the vitreous. This observation led him to examine several patients with tuberous sclerosis, to determine whether the picture found bore any relation to the disease. Five other patients suffering this disease showed similar symptoms. All these six patients with tuberous sclerosis had flat retinal tumors in each eye, and in two eyes tumors on the disc were found. Tumors in the fundus are consequently a part of the clinical picture of tuberous sclerosis. (See under Pathology.)

RING SCOTOMA.—Of a total number of 22 employees in the telegraph service, including those reported on formerly, examined by **Zade**, all but two showed the typical peripheral ring scotoma previously found by him. As formerly, a 4 mm. white object was used in perimetry at 50 cm. and he is convinced that his findings are correct.

In a hysteric young woman of 18 years, the patient of **Oguchi** and **Shima**, a double ring scotoma was observed. The inner ring went thru the blind spot. Varying with the general condition of the patient, the condition often changed or even disappeared. According to Woefflin, ring scotoma is a symptom in *hysteria.*

EFFECTS OF LIGHT.—In a clinical lecture, **Fuchs** discusses the effect of various radiations on the eye. The influence of ultraviolet light on the origin of senile cataract is denied, and that on senile macular changes is still to be decided. The central scotoma after looking at the sun is not due to heat effect. Ultraviolet light is the cause of snow blindness and erythropsia. Against visible rays, grey glasses; against ultraviolet light, yellow glasses are indicated.

Referring to Siegwart's experiences (Y. B. 17, p. 234) as to the pain of glare, **Peters** takes exception to some statements attributed to him by Siegwart, but agrees with the author as to the part of the pupillary contraction on the pain.

Two instances of injury by watching the eclipse of April 8, 1921, came under the observation of **Lodge.** 1. A woman, aged 42, after watching the eclipse, complained of dazzling and watering of the eyes, which soon passed off; but when addressing a ball in playing golf, a shadow appeared behind it. At the end of a week, the patient saw double, and she began glancing to the right. Vision was 6/12; metamorphopsia was present in the right eye. The field of the right eye contained a relative central and an absolute paracentral scotoma. In the relative scotoma, green appeared red and vice versa. 2. A woman, aged 42, using a blue glass similarly as the first patient had done in watching the eclipse in the morning, had no discomfort until the evening; when darning, the wool at the needle's point seemed indistinct.

The following morning, on closing the right eye, a bright image like the sun occasioned some discomfort, tho it would fade to bluish-green and disappear in a few moments. Two weeks later, a patch of old choroidal degeneration was found behind the right inferior nasal branch of the retinal artery. An ill defined relative scotoma for colors was around the fixation point; within it, red objects appeared green and vice versa. There seems to be a varying individual susceptibility to strong light; in certain cases of eclipse blindness, there may be a toxic element at work. This would account for the aggravation of symptoms days after their beginning. It is important to know that eclipse lesions may be permanent. The treatment is rest in bed in a darkened room, with protecting glasses, miotics, strychnin, iodid of potassium. The metachromatopsia found in his two cases was explained as disturbances of the normal reflexes connected with color vision resulting from harmful stimulation by strong light.

The two instances of *eclipse blindness* observed by **Archer-Hall** were the result of short exposure, showed changes in the fundi and a temporary central scotoma and ended in complete recovery. One of the cases he describes in detail. A young woman, aged 27, watching the eclipse of April 8, 1921, for a few seconds, used no protection. On the following day, things were blurred and she could not see the center of things. In each macula a yellow glistening line was seen; there was also slight pigmentation around the macula. Iodid of potassium was ordered. Two weeks later, vision was normal and fundus changes had disappeared.

Following the eclipse of April, 1921, **Maxted** observed two cases of blindness. The first case was that of a girl of 18 years, whom he saw 3 days after. A few minutes after looking at the eclipse thru black spectacles, everything looked blank; central vision was less than 6/60, a large central scotoma existed for white and colors. No fundus lesion beyond a possible slight injection of the disc. Twelve days later the fundi were still unchanged. No metamorphopsia was present.

In the case of eclipse blindness of **Matthews**, there was a small pale oval area at the macula.

Two cases were presented by **Ewing** as showing *heat and light injuries* to the retina and choroid. A man had been operated on for cataract of the left eye with resulting normal vision. Four years later, after right cataract operation, he had a postoperative central retinal hemorrhage. He found his vision failing two days after inspecting for several hours some blast furnaces. In the left eye was found a fresh diffuse disc size *hemorrhage* in the lower portion of the macula, acompanied by slight retinal edema. Vision gradually grew worse and a retinochoroidal scar developed. The other case was that of a man, aged 35, who found the vision of his left eye failing six days after a 150 Watt electric bulb had exploded with a flash near him. Ten days after the accident, extensive diffuse central retinal hemorrhage was seen, and in addition two smaller ones between the disc and macula. Vision gradually decreased. In the right eye, retinochoroidal scars were seen in the periphery, which were probably caused by an injury years before.

In the discussion, Shoemaker, quoting the experiments of Verhoeff and Bell (Y. B. v. 14, p. 238) thought it was the heat that affected the retina and not the light, and mentioned a patient who several months after watching an eclipse had vision 20/40 without any fundus changes. Higbee related the case of an electrician who developed bilateral cataract, after being burned by an electric current, and whose right fundus showed retinal proliferation after the extraction. The case of a young man who developed numerous hemorrhages in each retina after the use of an acetylen torch; and a patient who developed an eclipse scotoma in the form of a half circle. It is concluded from the latter experience, that it must be the light that affected the retina. Shahan related experiments on rabbits he had undertaken together with Post, which showed that exposure of the sclera to heat of about 160° F. would produce edema of the retina and destruction of the blood vessels in the area corresponding to the exposed sclera.

RETINAL CYST.—In the right eye of a woman, aged 57, **Danis** observed two round transparent cysts of the retina, which projected into the vitreous, showed no movement and were covered with blood vessels. One cyst was at the temporal side of the disc and partly covered it; the other one was at the nasal side and slightly below.

In a woman, aged 56, who had a cataract operation and discission on the right eye five years before, and who later developed detachment of the retina, **Brav** found hemorrhage in the anterior chamber and an opacity which apparently was nothing else but a bloodstained cornea. After corneal section for the purpose of exploring the anterior chamber, a little thin fluid of yellowish tint came out, followed by a gelatinous mass. After the operation, the eye began to soften and to get smaller. Histologic examination of the mass removed during operation declared it to be a mucinous cyst. The mass was about the size of a dime, gelatinous, and had the appearance of a bag, resembling placenta. It is assumed that a *subretinal cyst,* which had produced detachment, had escaped thru the incision, after the retina had been ruptured during the operation.

SUBRETINAL CYSTICERCUS. — The patient of **Pillat** became affected with trichinosis from eating raw ham in February, 1919, with fever, nausea, vomiting, diarrhea and swelling of the iids. One year later, during influenza, vision of the right eye became cloudy, and subretinal cysticercus was diagnosed. Four months later, Dimmer removed the cysticercus under general anesthesia, after temporary resection of the external rectus. Vision, formerly fingers at one meter, improved after the operation.

DETACHMENT OF RETINA.—Since his report on the relation of diminished tension and detachment (Y.B., 17, p. 256), **Kuemmel** had occasion to examine six eyes more. Of the total of 52 eyes, 45, among them 16 of not longer than two weeks standing, showed diminished tension compared with the other healthy eye. That the subretinal fluid is not vitreous which had escaped thru a retinal tear, is proven by the greater albumin content of the subretinal exudate. Against this speaks also the frequent beginning of the detachment in the upper portions. Shrinking of vitreous bands as a cause of detachment cannot be harmonized with later reattachment. The whole anatomic and physiologic condition of the uvea must be considered. Infiltrations, degenerations and hypertrophies of the whole uvea exist, even if in a mild degree.

The ciliary processes may possibly regulate the intraocular pressure; their affection will lower the ocular tension and the accompanying vitreous degeneration will help produce detachment. Diminished pressure in the vitreous leads to transudation from the choroid. That the subretinal fluid is under greater pressure is proven by his case, in which the subretinal fluid was seen to enter the vitreous thru a tear in the retina. The edges of the retinal tear are most of the time turned in towards the vitreous. Iridocyclitis and cataract are the consequences of the original process. Everything reducing the ocular tension must be avoided. Evacuation of the subretinal fluid should be followed by measures which would press the retina in place. As to the question of compensation it is possible that physical exertion will lead to exudation from the choroid with resulting detachment.

The in-patients with detachment in the Heidelberg Clinic during the years 1901 to 1912, already discussed extensively by Seible (Y.B., v. 16, p. 191) are the subject of a paper by **Schreiber.** Of the 163 cases with 186 affected eyes, 12 patients with 14 eyes could be considered as permanent cures, having been examined carefully with dilated pupils, thus giving a percentage of 7.4 and 7.5% respectively. The cures had been lasting from 2 to 16 years; in one half of the cases, high and severe *myopia* existed; myopia could only be blamed for the detachment in 4 cases, since the other 4 also showed some exudative processes in the uvea. Myopia was the cause of detachment in 62 cases, with 69 eyes, of the whole number. The cures of the myopic detachment occurred, therefore, in 6.4% of the cases and in 5.8% of the affected eyes.

Of the 17 cases, with 19 eyes, with primary subretinal exudate, cure was observed in 5 cases, with 6 eyes. In the 5 cured cases, chronic and acute rheumatism is assumed as the cause for the detachment in 4. The rheumatic detachment is characterized by the fact, that it does not appear as an isolated affection of the choroid, but that other inflammation such as iritis, cyclitis, episcleritis and tenonitis precede or accompany it. Bilateral detachment in nonmyopic eyes was observed in a mother and her son. Retinal tear was found only once in eyes with cured detachment. Of the whole number of 163 cases, tears were found 9 times in myopic and 10 times in nonmyopic eyes, 12.3% of nonmyopic eyes. This Schrieber considered as a proof, that Leber's view of traction as the cause of myopia is equally true for nonmyopic as it is for myopic detachment.

The treatment was generally conservative; rest in bed, mercury, sweats, iodides, salicylates, subconjunctival saline injections and hot applications. Only three times was operative treatment resorted to. In a detachment from an intraocular piece of iron, magnet extraction was practiced. In the one case operated according to Deutschmann, the cure occurred two days after the operation. But the author is not so sure about the cause of the cure in the case, since it was one of primary subretinal exudate on a rheumatic basis. In the third case, the cure occurred so long after discharge from the clinic, that the cure can be more correctly classed as spontaneous. In the rheumatic detachments, a scleral puncture is preferable to the more serious Deutschmann operation.

In 61% of **Uhthoff's** series, myopia was the cause of detachment. He discusses idiopathic detachment from primary exudation or shrinking of newly formed cellular tissue, together with shrinking of the vitreous and secondary accumulation of fluid behind the retina. The pressure bandage must not be too tight, the patient should remain in supine position, tho it is better at times to have him sit up because of the seat of the detachment. He favors diaphoresis, but too heavy doses of pilocarpin and salicylic acid are to be avoided. Strong solution of sodium chlorid injures the tissues and may obliterate Tenon's capsule. Of 351 cases of reattachment collected, 24% followed operative procedure, 45% resulted from conservative treatment and 31% were spontaneous. Of his own cases, 28% of cures followed conservative treatment and 22% operative intervention. Of all his cases, about 9% showed final reattachment. Simple or double puncture of the sclera and evacuation of the exudate is harmless but recurrences are frequent.

Detachment is likely to occur from one to several years after any severe blow on the hand or the eye, in spite of an apparently complete recovery from the immediate effects of the injury, **Gifford** points out. This fact is of importance on account of prophylaxis and the advice to the patient concerning compensation. The entire fundus should be examined for small hemorrhages, or areas of opaque and raised retina, which are frequently found in the periphery. Such patients should be kept in bed, or sitting up at ease, with both eyes bandaged for one week after the accident. In addition, salicylates and pilocarpin are to be given. In severe injuries, longer bandage and treatment is necessary. For a couple of years, such patients should avoid violent games, etc. Compensation should be settled only with the full recognition of the possible future loss of sight from late detachment. A good many detachments of early life are the late result of traumatism. Perforating wounds may cause late detachment from formation of vitreous bands. Three cases are quoted in illustration.

Alluding to the case presented by Rochat, of detachment occurring sometime after injury to the back of the head (Y.B., v. 15, p. 160), **Dubois** relates the case of a boy of seventeen years, who, after falling on the back of his head, noticed a few hours later that the upper part of his visual field seemed covered with a curtain. Detachment was found in the lower part of the retina, but no rupture. In the discussion, Cuperus related a case of a railroad worker who, falling, struck the back of his head on a rail and showed, a few days later, detachment of the retina without any rupture. The eye ultimately became blind from total detachment.

The danger of detachment in myopia, **Dor** believes, is exaggerated. Danger exists only in those cases that have no choroidal complications, but when such exist there is no danger of detachment of the retina. He emphasizes the fact that detachment never occurs in myopia with posterior sclerochoroiditis. Such of his patients are, therefore, advised to do all near work.

In the left eye of a myopic woman, aged 46 years, **Herschdoerfer** found total flat detachment of the retina, of greyish-white color on the temporal side and deep red on the nasal side. In the macula was a horizontally oval hole, about 1 d.d., pigmented at its upper margin; thru the hole a branched choroidal vessel could be seen, showing marked parallactic movement compared with the edge of the hole. A few days later, a posterior synechia, tremulous iris and great hypotony appeared. In the discussion of **Cross'** paper on the fundus in War, Scarlett mentions cases of detachment seen, especially one in a private after an extensive wound of the right face. Within five days, the vision of the left eye sank from 2/40 to light perception, due to enlarged detachment. Chance mentioned three cases of uncomplicated detachment.

In the right eye of a child demonstrated by **Brazil,** there was apparently detachment in and below the macula. Several members were of the opinion that no actual detachment existed, but that the appearance was wholly due to the excessive irregular corneal astigmatism caused by nebula. A case of detachment was demonstrated by **Davidson,** in order to obtain expression of opinion as to treatment.

Discussing the *heredity* of detachment, **Salzmann** refers to the myopic detachment found by Alt in three generations, and his own two cases in three myopic brothers. Myopic choroidal changes are in direct relation to the degree of myopia; this is not the case in detachment. He has observed detachment in a father and his son, in both instances in the lower temporal quadrant of the left eye; in the father it came on in his fourteenth year, and the son developed it in his twelfth year, after injury by a stone throw. In both instances the detachment was sharply demarcated by blackish-white border lines.

The *retinal cysts* are in close relationship to the pathogenesis of spontaneous detachment, according to **Gonin.** They are found already in fresh cases, and not only in the later stages, as assumed until now. With the ophthalmoscope, one can occasionally observe their development together with the detachment. Such an example is described and illustrated by drawings.

In a mild case of *sympathetic opthalmia,* **Salzmann** found the retina detached in the periphery to the extent of 2 to 3 d.d. The detachment extended onto the orbicularis ciliaris, and the ora serrata thus became visible with the ophthalmoscope. Detachment of the orbicularis ciliaris can easily produce relaxation of the suspensory ligament and thereby increase the refraction; a traumatic myopia may thus originate under certain conditions. (See Salzmann under Examination.)

In the left eye of a 15 year old boy, with right traumatic iridocyclitis, **Aykai** found slight symptoms of inflammation and detachment below, together with disturbance of hearing. The injured right eye showed histologically the typical picture of sympathetic inflammation. After the enucleation, the detachment gradually disappeared, and the fundus finally was dirty with small pigmentations, and, in the area of the detachment, yellowish-white irregular stripes.

After recovering from an attack of acute glomerular *nephritis* with edema, a boy, aged 14, the patient of **Weisfelt,** developed symptoms of contracted kidney, 4 years later. During an exacerbation of the chronic uremia, bilateral detachment of the retina occurred without choked disc. Uremic coma and convulsions persisted for 80 and 45 hours on two occasions; the detachment occurred at the second attack, not long before death.

Bilateral globular detachment in renal retinitis in an officer, aged 21 years, who suddenly became unconscious and developed convulsions in consequence of parenchymatous nephritis, was observed by **Calhoun.** Disturbance of vision was noticed a few days later, when the patient became conscious. In each eye there was intense neuroretinal edema, with the outline of the disc completely obscured; the veins were engorged and tortuous, arteries sclerotic; there were many flame like hemorrhages and exudates especially involving the macula. Intervals of improvement were followed by return of edema and hemorrhages, until a few days later, each eye showed, in the upper part, detachment, which soon became multiple and globular, so that it could be seen by oblique illumination. About six weeks after onset of the symptoms, patient died from suppression of urine. In eight cases of ocular disturbances during typhus exanthematicus, **Marin Amat** found retinal detachment, postneuritic atrophy, corneal ulcer, etc.

Treatment of Detachment.—Tho intending only to discuss the treatment of detachment, **Gonin** again reviews the clinical and anatomic features of idiopathic detachment (Y.B. 17, p. 254). He limits himself to the methods of treatment which he has personal experience. 1. The compression bandage of Samelsohn, if really compressing, is rarely tolerated, and produces superficial keratitis and painful cyclitis. It need not be compressive; it must be immobilizing. This allows the tear in the retina to heal, the subretinal fluid to become absorbed and a retinochoroidal scar to form. When the detachment has occupied the lower portion, horizontal decubitus is not indicated. The patient should, while in bed, rest on pillows, and lean his head back when sitting up in a chair. The treatment of Samelsohn continued for two or three weeks gives undoubted results, but since relapses occur, it is necessary to continue treatment, in a rocker, and the patient must later on sleep with his head as high as possible. The other measures suggested in conjunction with this treatment, such as foot baths, purges, sweats, etc., are of problematic value.

2. The purpose of *subconjunctival injections,* used with the treatment of Samelsohn by some authors, seems to him rather enigmatic, and he can see in them only some value to prevent trouble, if used on the unaffected eye, by improving its nutrition; used on the diseased eye, they may prevent adhesions and increase the tonus of the eye, and above all help continuance of the occlusive bandage.

3. Scleral puncture gives results, but they are not lasting; thermocauterization is possibly more effective, but it must perforate sclera, choroid and retina; but it may, by scar formation, produce detachment at a point opposite to the cauterization. This method represents the last hope, and should not be used when the patient has this eye only. As to Deutschmann's method, it would seem more logical to have it used in recent cases; and not in the old ones, as Deutschmann suggests, where the vitreous is already retracted toward the lens. He is sceptical about this method in spite of the vitreous injections, and points out that Deutschmann is the only one who reports good results.

Assuming that *thyroid* substance increases the flow of secretions from the ciliary processes, as it increases the flow of tears, saliva and other glands, **Lamb** reasoned that this remedy, in doses of 1/2 gr. three times daily, would lead to the increase of intraocular tension, and would thereby hold in place the retina after it had become reattached by the withdrawal of the fluid behind it. The absorption of the subretinal fluid was to be hastened by subconjunctival injections of 1/3000 cyanid of mercury, 15 drops, combined with 3 drops of 1% acoin, every seven or ten days. In addition the body fluids were to be changed by Murphy drip, containing 10 grams of sodium carbonat and 20 grams of sodium chlorid to a liter of water, daily or at longer intervals. Fibrolysin would increase the white corpuscles. Locally, pilocarpin, dionin solution and hot applications, together with internal use, every four hours, of 5 grs. each of hexamethylenamin and aspirin. This treatment was carried out in a case of extensive detachment. Vision became sufficiently restored for the patient to read. Similar treatment, but less strict, was carried out in another case, because the conditions demanded that the case be treated ambulatory, and the field of vision increased.

Discussion by different speakers followed: Hansell emphasized the necessity of the knowledge of the etiology and of the morbid processes; detachment is rather a symptom than a disease; failure of treatment may be due to ignorance of etiology, or to the impracticability of any treatment directed toward the symptom and not the disease. Chance welcomed the increasing understanding of the metabolic processes affecting nutrition and the purposes of the endocrine system; a course of treatment as outlined by Lamb should be given even after operations. Peter related a case of a woman, aged 28, with blood pressure of 240, in the fifth month of pregnancy, who developed rapid loss of vision and complete detachment below and beginning detachment above, in each eye. Induction of labor was practiced, hot packs, rest in bed, bicarbonat of soda by mouth and saline purges were ordered for six weeks· at the end of which time, complete reattachment was found, with minute atrophic spots here and there. Heed reported the present vision of his case (see above) to be 6/21 plus, with full visual fields. Ziegler found thyroid extract useful in detachment, also in subretinal hemorrhage; detachment after blow on the head is most responsive to this treatment. He had excellent results after posterior sclerotomy in cases seen early, but it is difficult to formulate exact rules of procedure.

Tho fully realizing the unfavorable prognosis of detachment, **Moore** has, during the last two years, admitted all patients who were willing to the hospital, where they were confined to bed. Every third day, an injection of 15 mm. was made under Tenon's capsule, over the seat of the detachment; 5% sodium chlorid was alternated with 5% sodium citrat, each with an addition of 4% novocain; 9 to 10 injections. The case is related of a myopic man, aged 44, with a large transparent detachment in the left eye down and out. After a month's treatment, detachment completely disappeared.

Blocking of the anterior drainage of the eye by simple conjunctival cauterization, or by cauterization all around the cornea, for the purpose of raising the lowered intraocular tension, was proposed by Lagrange in 1912 (Rev. Génér. d'Opht., p. 379). For this operation, **Pesme** now proposes, on the suggestion of Lagrange, the name of "Calfeutrage" instead of "Colmatage." Two or three days after the operation, the intraocular tension rises rapidly; then the curve falls, only to show slight elevations after each of the deep hypertonic injections which are part of the treatment. At the end of the first month the curve reaches a level always higher than the initial tension, but often below that of the final tension. Then begins the intermediary stage, during which the curve forms more or less of a plateau. But an occasional drop in tension can be observed, especially in recent detachments in which the initial tension had not yet reached a low level. After six months, the cicatricial sclerosis begins slowly and progressively to block the anterior drainage passages.

Thirty cases treated in this manner are reviewed, the oldest 8 years under observation and the youngest 6 months. The 30 cases comprise 22 of myopic detachment, 4 of serous detachment, 1 traumatic detachment, and 3 cases of low tension in high myopes. Of the 22 cases of myopic detachment, 18 showed decided rise in tension, 3 remained stationary. There was 1 decided failure in a patient who refused repetition of the operation, which gave good results in other cases. All 4 cases of serous detachment showed increased tension; the same was also the case in traumatic detachment and the cases of diminished tension from myopia. Complete reattachment could be observed with the ophthalmoscope 12 times in myopic detachment and 1 time in choroiditis; the traumatic case showed no change. In all of the 27 cases of detachment, 15 cures. In 9 cases of myopic detachment the field was entirely normal, 9 times it had become wider. Of serous detachments, 4 showed normal field and 2 increased fields. There was a corresponding increase of vision.

Of the two cases operated by **Chipman**, according to the method of Thomson (Y.B., 12, p. 214, Y.B. 13, p. 218; Y.B. 17, p. 253) at least one was successful. 1. A man, 47 years, with detachment in the upper outer quadrant following a blow from a shovel handle. Operation resulted in reattachment and restoration of the field, conditions which still persisted some time later. 2. A man, aged 65, with large flat detachment on the temporal side, in existence for three weeks. After an operation, there was little apparent improvement, but two weeks after discharge from the hospital, central vision was 20/200 and the field was greatly enlarged.

The results of Holth's preequatorial sclerectomy in 35 cases of detachment are reported and analyzed by **Groenholm.** 36 eyes were operated on, and 5 of these were operated on twice, making the total number of operations 41. At first Holth's original technic was followed, but later a 2.5 mm. trephine opening was made in the sclera over the seat of the detachment. The primary results of the operation were very good, cures in more than 50%. 26 cases could be observed from one-half to six years; the final results in these cases was 10% cured, 24% unchanged and 67% worse. In most of the cases the operation had, therefore, only a transitory effect. The smaller the detachment the better the results of the operation, primary as well as final. As to the duration of the disease, the primary result was favorable in 65% of the early cases and 40% of the older ones; early operation is, therefore, indicated. Rupture of the retina seems to give an unfavorable prognosis.

Of myopic eyes, 48% were improved or cured; of nonmyopic eyes 65%. Of five cases treated according to the older methods and showing no appreciable results sclerectomy produced cure in 1 and improvement in 4, but only in one case was the improvement lasting. In 3 cases the conservative treatment had an excellent result, and the operation was only made to make the result permanent. The operation is harmless, and waiting might be dangerous. Vision is only temporarily influenced by the operation. Sclerectomy is no ideal operation, its effect is fleeting; but the detachment is improved for at least a short period, and it is definitely cured in about 10% and definitely arrested in about 24%. If the first opening has closed, new openings are to be made as long as there is hope for improvement. The operation is harmless compared with the danger of the disease.

The detachment in the upper part of the left eye of **Damel's** patient disappeared after trephining with an Elliot trephine, between the superior and external recti muscles; vision improved and the field became normal. Five weeks following a modified Mueller resection of the sclera, the detachment of the entire temporal half of the retina, in existence one month in **Heed's** patient, was gone. There was only a moderate elevation at the site of the operation. Good fields and central vision 6/13.

Application of *Roentgen rays* are said by **Vigano** to favor resolution of cicatricial adhesions and resorption of hemorrhagic effusions and inflammatory exudates and infiltration, and to act on detachment of the retina. He reports the case of a man, aged 69, with almost total detachment of the retina whose vision improved after six applications, improvement still persisting one year later. Iodin was taken in addition.

Toxic Amblyopias

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This section of the digest carries the literature from July, 1921, to July, 1922. For previous references see v. 17, 1921, p. 275.

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DIGEST OF THE LITERATURE.

TOBACCO AMBLYOPIA. — **Doyne** observes, that since changes in the activity of the central retinal zone form so important a factor in the early diagnosis of glaucoma, it is important that more exact knowledge of the various types of scotomata associated with the different diseases affecting the central zone should be determined. In studies of tobacco amblyopia, the author attaches most importance to the results obtained by the use of a white test object. When using colored test objects, difficulty is met in trying to make the patient adopt a standard saturation. Red is easier to work with than green. Green test objects proved unsatisfactory. While he uses Bishop Harman's scotometer, he feels that Bjerrum's screen is the method of real accuracy. A 2 mm. test object is used, but for colors a 4 mm. object is used outside the ten degree circle. In tobacco amblyopia, there appear to be three types of scotomata:

(1) A large scotoma involving the blind spot and the area between the blind spot and fixation, but which stops just short of the actual fixation point.

(2) A scotoma lying close to fixation, within the five degree circle, connected by a relative area to the blind spot, which may or may not be prolonged towards fixation.

(3) A scotomatous finger pointing from the blind spot towards fixation.

These three forms demonstrate different degrees of severity. Three typical illustrative case histories and eleven charts accompany the contribution. In early glaucoma, the earliest scotomata are found along the ten and fifteen degree circles, or from the upper or lower borders of the blind spot. In tobacco amblyopia, it is the area between the blind spot and fixation which is first involved. Finally, the author, in later cases, takes the after images for red, green, and blue. Tobacco patients will see a yellow after image of the blue card, but, except in mild cases, will not appreciate the after image of the red or green. They state after red, its size looks rather brighter and after green rather darker than the surrounding area.

During a period of eleven years practice in Egypt, **Meyerhof** observed but three patients, and these not natives, with injury of the optic nerve by tobacco, out of thirty thousand patients. Southern Europeans smoke strong cigarettes. Since 1917, the author has observed, in Germany, out of thirty-four patients with chronic bilateral retrobulbar neuritis, eleven cases of tobacco amblyopia. During the food blockade, a striking increase of chronic affections of the axial fascicle of the optic nerve has been observed by others also. He thinks that in persons abstaining from alcohol, it is chiefly the tobacco juice accumulated in the cigar ends which produces the effection of the axial fascicle of the optic nerve, cigarettes and pipe never or at most rarely, chewing tobacco rarely. The danger may perhaps be diminished by the use of cigar holders.

ETHYL ALCOHOL AMBLYOPIA.—**Ischreyt** reports the clinical histories of six cases of acute intoxication by ethyl alcohol, probably adulterated with methyl alcohol. The course was very violent. From a few hours to a few days after ingestion, the first visual disturbance appeared as obscurations, and increased rapidly to intense amblyopia, or complete amaurosis, with headache, vomiting, vertigo, and difficult breathing. After a stage of striking improvement, a deterioration set in, which determined the final fate of the patient.

Peculiar was the frequency of the central scotoma, which was observed in four patients. The author believes that this is much more frequent in intoxication by methyl alcohol than is reported in the literature. The disease is so violent and the impairment of vision so rapid, that examination by an ophthalmologist comes too late to ascertain the origin of the change, not to speak of the cases in which the severe general symptoms put the ocular symptoms into the background.

Ischreyt's cases of rather certain intoxication by methyl alcohol gave him no reason to contrast them with those from ethyl alcohol, and he sees in them rather quantitative than qualitative differences. He considers the frequency of central scotoma decisive for their interpretation.

In one case, optic atrophy set in after one and one-half months, one recovered without ophthalmoscopic changes. In the others, the onset of atrophy could not be observed, but it was ascertained in one after one month, one after two months, and in one after five months. One showed slight neuritic changes.

Terson is of the opinion that the visual troubles caused by the abuse of *alcohol,* generally associated with *tobacco,* should attract the attention of physicians, because their typical signs often permit suspicion of the nature of the trouble without, or before, ophthalmoscopy, and because medical treatment cures the condition, if complete and used in time. Symptoms are, that the patient sees more or less badly for distance; he sees better when the light is poor; better in the evening than at midday, when he is dazzled. This is explained by the fact that such a patient has a central scotoma of the visual field; and anything that dilates the pupil, or allows it to dilate, aids his vision, and inversely. The patient may or may not be able to read, according to the degree of intoxication, but he has special difficulty in recognizing colors. The two principal questions to ask are, do you see better toward evening, and, can you recognize red and green colors of small objects readily? Above all examine the urine to exclude diabetes. Treatment; immediate abstention; encourage sleep (bromides, veronal); diuretics, laxatives, baths, massage, exercise in the open air; no spices or salty food; green vegetables; abundance of water; no coffee or tea; strychnia, iodides, but above all phosphorus, especially in the form of injections.

Brown reports two cases of toxic amblyopia from *alcohol* and Copenhagen snuff. The first was a man, aged 45 years, who for twenty years chewed one ounce of Copenhagen snuff and drank six ounces of vanilla extract every night. Vision: R. 20/70, L. fingers ten feet; later R. 15/200, L. fingers thirty feet. Slight atrophic cupping of disc, vessels contracted. Form fields irregularly contracted twenty to forty degrees, red abolished, enlarged blind spots and left paracentral blind scotoma. The second patient was a man, aged 34 years, who since he was 7 years, had used snuff and alcohol; since 18, used one ounce of snuff and alcohol freely. Vision: R. 20/40, L. 20/30. Form fields inside thirty degrees, red and green inside fifteen degrees. No central scotoma, blind spots large but impossible to determine their limits. Alcohol blindness is also discussed by **Rollet.**

Discussing toxic amblyopia, **Blegvad** and **Rönne** state that retrobulbar neuritis is, by the negative central scotoma and other clinical conditions, a well characterized disease of clinically and etiologically different aspects. This article reviews the lines of precision between a series of etiologic units, chiefly alcohol-tobacco amblyopia, diabetic amblyopia and Leber's hereditary neuritis. These are distinguished from the other forms of retrobulbar neuritis by their constant bilateral occurrence and their preponderance in men. The twenty-three idiopathic cases, observed by Jensen and the author in Denmark, are identical with the hereditary type, with regard to the age at which they commenced and to vision, which is much less than in intoxication amblyopia. Also, the predominant number of family histories with only two members affected indicates with certainty that isolated cases must occur. This also applies to women. The diabetic amblyopia is well characterized by its easily recognizable etiology.

During the war, a surprising change occurred in Denmark in the clinical aspect of alcohol amblyopia, bringing it in many relations nearer Leber's disease with regard to its character. In consequence of the exorbitant price, alcohol has been replaced by denatured spirits, which resulted in a more serious affection, while the alcohol amblyopia proper has decreased. The denatured spirits consists of crude cooking spirits with admixture of pyreidin, picolin, fuchsin and rhadamin, which are not toxic. Its poisonous action must depend on its content of amyl, propyl, isobutyl alcohols, etc. It seems that pure alcohol is not so toxic as when impure by the admixture of the different kinds of alcohol of higher constitution.

With regard to the differential diagnosis of other forms of retrobulbar neuritis, it scarcely occurs in multiple sclerosis as an initial symptom, before the development of other cerebrospinal changes. The authors are very skeptical as to syphilitic retrobulbar neuritis. The number of isolated cases of Leber's disease appear to have abnormally increased during the war, undoubtedly due to the fact that physical handicaps incline to the outbreak of the disease. **Meller's** contribution deals with retrobulbar neuritis and toxic amblyopia.

METHYL ALCOHOL AMBLYOPIA.—In a very excellent contribution, **Ziegler** discusses the ocular menace of wood alcohol poisoning. The author comments upon the temptations which prompt the substitution of the poison; the commercial sources of the supply; tests for its detection; the point of entry thru the mouth, nose and skin; symtomatology; papillitis, retrobulbar neuritis, sudden sclerosis; treatment; and report of six illustrative case histories. He concludes by stating:

1. Wood alcohol is the most deadly poison used in daily commerce.
2. One teaspoonful has been known to cause blindness, and one ounce to cause death.
3. The port of entry may be thru the mouth, nose or skin.
4. Wood alcohol should be identified by Robinson's test. (Robinson converts the wood alcohol by oxidation thru potassium permanganat into formaldehyd, then adds it to acidulated milk, and gently heats the mixture until a pink color develops. This test is so delicate that 0.01 per cent of methyl alcohol will be revealed.)
5. It is protoplasmic poison, possessing a selective affinity for the delicate nerve tissue of the eye.
6. It is modified by oxidation, first to formaldehyd and then to formic acid, both of which are corrosive poisons.
7. Formic acid is the end product excreted by the kidneys.
8. If formic acid is present in the urine, it will promptly reduce Fehling's solution, thus suggesting to the inexperienced a false diagnosis of diabetes.
9. Van Slyke's test will reveal acidosis in the early stages and alkalosis later.
10. Sudden blindness with vomiting and abdominal pain should always arouse suspicion of methyl alcohol poisoning; especially if diplopia or ptosis is associated.
11. Papillitis, sector like atrophy and sudden sclerosis of the nerve head are equally typical fundus lesions.
12. Symptoms of pituitary injury are most suggestive in pointing to this as the primary and fundamental lesion.
13. Contracted fields and central or paracentral scotomas are usually present.
14. Treatment should include early neutralization by alkalies, and elimination by lavage, emetics, diaphoretics and rapid oxidation; together with stimulation of the optic nerve by negative galvanism applied directly to the eye. Thyroid extract and pituitary extract may be indicated.
15. The manufacture and sale of wood alcohol should be prohibited or regulated by law.
16. If sales are permitted, safeguards and warnings should be required, and the public instructed as to the great danger to vision and life.
17. A special revenue tax with registered "poison sales" would regulate and record its distribution, and in cases of poisoning reveal the source.
18. This tax should equalize the cost of denatured alcohol and methyl alcohol, and thus remove the temptation to adulteration because of cheapness.
19. All wines, whiskies, toilet articles and patent medicines imported from foreign countries should be tested for wood alcohol before passing thru the Customs inspection.
20. The name "methanol" specifically designates this product, and yet avoids the tempting suggestiveness of the word alcohol.

Rostedt relates, that since the complete prohibition of alcohol in Finland, cases of injury to the eyes from substitutes for brandy have totaled sixty. He says that this represents a new pathologic condition in Finland, and he protests that it cannot be called methyl alcohol poisoning, as methyl alcohol is not so injurious as wood spirits. Franceschi has reported that he administered to himself 32 gm. of pure methyl alcohol daily for a period of nine months, thus a total of 9 kg., without appreciable injury. The toxic elements in wood alcohol are the fusel oil and other substances. In fifty per cent of the sixty cases, blindness followed, while amblyopia was pronounced in all. The visual disturbances developed about the third day in the majority, and then continued a progressive course for from two to four weeks, after which there was usually slight improvement but, as a rule, it was only transient.

A case of wood alcohol poisoning with unusual complications was observed by **Barbash.** A man, aged 50 years, developed an active delirium, following a drink of whiskey containing wood alcohol. He could count fingers, but one day later was unable to see at all. He developed considerable meningeal irritation with positive Kernig's and Babinski's sign. Spinal and blood Wassermann negative. On the ninth day, the right pulse could be obtained only in the axillary artery. Coagulation test showed one minute and forty seconds. Upon surgical investigation, the entire arterial tree in the forearm and hand was found to be filled with clot. Gangrene developing, and amputation at the mid forearm was done. The report does not state what the ultimate conditions of the eyes were.

Pincus reports the clinical histories of three cases of blindness from intoxication by methyl alcohol, treated with lumbar puncture. One left the hospital clandestinely, and his case is not reported to show the value of this treatment, but the other two cases, after lumbar puncture, took a favorable course. **Heckel** exhibited a patient who had suffered with wood alcohol amblyopia. Recovery followed elimination and strychnia treatment. **Mackenzie** also writes and reports case histories of wood alcohol poisoning.

ARSENIC AMBLYOPIA.—**Flury** writes of his observations on war gas poisoning and local irritation from arsenic combinations. **Schoute** observed transient disturbances of vision from arsenic. **Palomar de la Torre** observed a case of toxic neuritis from the use of salvarsan. (See p. 321.)

Lavagna discusses *lead amaurosis;* and **Killen** the contraction of fields following sleeping sickness. Illustrations accompany the contribution.

QUININ AMBLYOPIA.—**Ischreyt** observed a woman, aged 25 years, who in one day took, at intervals, six quinin tablets. The following morning there was total amaurosis, without ophthalmoscopic changes. Two days later, the macular and optic disc regions were pale and opaque, arteries narrow. On the fourth day, normal vision, white fields almost normal, but contracted for yellow and blue, which indicated a lesion of the pigment epithelium. No central scotoma.

Giraud reports the case of a young woman who took six grams of quinin with criminal intent. Its use was followed by vomiting, anuria and contraction of the field of vision. The optic nerves were blanched and the retinal vessels greatly contracted, with an associated periarteritis. The unusual feature was the yellow spot a little above the macula. **Sir, DuToit,** and **Killen** each contribute to the subject of quinin amblyopia.

Rathery and **Cambessedes** report a case of quinin amblyopia in a soldier, who had taken frequent doses for old malaria. One day, he took about nine grams of the drug. Late in the afternoon, he began to have buzzing in the ears, and before going to sleep vomited. During the night he awoke and turned on the electric light, to find that he could not see anything. The pupils were found to be very much dilated and the urine showed blood and albumin. The next day it was discovered that slight central vision remained in the right eye, and gradually the sight returned to normal. Ophthalmoscopic examination showed a pale disc with restriction of the blood vessels. (See also p. 331.)

MISCELLANEOUS.—A study of the pathologic anatomic changes from *dichlorethyl sulphid* is a contribution by **Heitzman.** **Velden** discusses lesions after poisoning with the same substance. **Reis** observed a case of optic nerve disease following exposure to *trinitrotoluol.* **Perlia's** case was one of retrobulbar neuritis due to inhalation of *benzol.* *Nirvanol* poisoning was observed by **Carsten.** **Lindberg** observed the action of *naphthalin* on an embryonic eye.

The Optic Nerve

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This section carries the literature from August, 1921, to August, 1922. Closely related topics will be found in the section on Visual Tracts and Centers. For previous references see O. L., 1921, v. 17, p. 282.

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DIGEST OF THE LITERATURE.

ANATOMY OF OPTIC NERVE. — A method of recording the various types of excavation of the optic nervehead has been proposed by **Gradle**, who has arranged a series of diagrams to indicate the depth, character and location of the excavation observed in each particular case.

Stöhr finds, that in contrast with the dural sheath, the pial sheath of the optic nerve is only sparingly provided with nerves. Vessels 80 microns in diameter have only 2 or 3 very fine nerve fibers; but besides these, there are nerve bundles that have nothing to do with supplying the vessels. The individual fibers of these bundles either divide into 2 parts, or give off branches which generally have a loopshaped course. The fine fibers form a closed network, which is much more rarely found in the pial sheath of the cerebrum. The nets do not extend uniformly over the whole pia, but have a certain spatial limitation. The vessel nerves of the pia originate from the carotid plexus, the others from the oculomotor nerve. Stimulation of them is rather dependent on variations in pressure in the cerebrospinal fluid in the pial sheath, and is influenced by the chemical condition of the fluid.

Hanssen writes of the genesis of myopia, and cites various theories (Haner, Weiss, Levinohn, Dinger), to the effect that traction exists between the bulbus and the optic nerve. He demonstrated, on the basis of microscopic sections, that, on the contrary, the optic nerve does not exert any traction on the bulbus, but that the bulbus, as it increases in size, compresses the optic nerve.

Werner describes artefacts in normal optic nerves. He showed sections of a normal optic nerve stained by Weigert's method, which exhibited the peculiar appearances first described by Siegrist as an unrecognized form of degeneration of the optic nerve, and which were subsequently shown by Elschnig to be artefacts, caused by injury due to manipulations with forceps and scissors in removing the eye or nerves.

RELATIONS OF OPTIC NERVE.—As expressed by **Schaeffer**, the retina embryologically is part of the brain. The so-called optic nerve is a brain fiber tract, supported by neuroglia elements and incomplete fibrous septa. There is nothing in the visual apparatus which corresponds to a peripheral nerve. The axons composing the "optic nerve," commissure and tract arise from the ganglionic cells located in the retina, and with the latter constitute neurons of the third order in the visual pathway. The axons, after leaving the globe, course centrally as the "optic nerve," optic commissure and optic tract, to terminate in the thalamus, metathalamus and midbrain. It would be more appropriate to designate the entire pathway as the optic tract. The fibers of the tract are medullated but lack a neurillemma, corresponding to brain and spinal cord fiber tracts in general. In animals, man included, with an overlapping of the fields of vision and stereoscopic vision, the decussation of the optic pathways in the commissure is incomplete, while in vertebrates below mammals, the decussation is complete or nearly so. The more laterally placed the eyes, the more nearly complete is the decussation. Therefore, in dealing with the anatomic relations which exist between the optic nerve and the optic commissure and the paranasal sinuses, one is concerned with a partially decussated brain fiber tract, with cell bodies located forward in the retina, rather than with a peripheral nerve.

For some distance behind the eyeball, the optic nerves are separated from the thin osseous walls of the paranasal sinuses by the interposition of a goodly amount of orbital fat. As the optic foramina and commissure are neared, the relations become more and more intimate between the nerves and the wall of the sinuses, resulting in many cases in the optic nerves and commissure coming into actual contact with the thin osseous walls or mucous membrane (when dehiscence is present) of certain paranasal sinuses, especially the posterior ethmoidal and sphenoidal.

For the purpose of this description, it is well to divide the optic nerve into sinus and nonsinus portions, the former referring to that part of the nerve within two mm. or less of the sinus wall. The great variations in size, shape, number and type, and the variations in symmetry and asymmetry of the paranasal sinuses, preclude any constancy in the topographic relationships of the optic nerve and the commissure to the sinuses. These variations are not discussed here for obvious reasons; but note must be made, that the thin osseous wall of the sinuses is often of a filmy character; or the wall may be developmently defective, so that the mucous membrane lining the sinus protrudes as a hernia. The thickness of the plate of bone between the optic foramen and the contained optic nerve, and the cavity of the sphenoidal sinus varies from a total absence to two mm. One or more of the posterior group of ethmoidal cells are nearly always intimately topographically related to the optic nerve. When a posterior ethmoidal cell extends into the body of the sphenoid bone, at the expense of the lumen of the sphenoid sinus, the ethmoidal cell in question replaces the sphenoidal sinus in the optic nerve relationship. The most dorsal ethmoidal cell concerns us in this connection. At times, other posterior ethmoidal cells, not in actual contact with the sphenoidal sinus, establish very intimate relation with the optic nerve.

The optic nerve crosses the upper and lateral angle of the sphenoidal sinus. In many cases, the wall of the sinus is pushed into relief by the nerve, so that the nerve virtually passes thru it and is separated from its lumen by only a thin osseous wall, or mucous membrane when dehiscences exist. The asymmetry of the sphenoidal sinuses may be so great, that either the right or left sinus establishes intimate and vital relationships, not only with the optic nerve of the same side, but also with the optic nerve of the opposite side. There is great inconsistancy in the relationship the optic commissure bears to the sphenoidal sinuses, due to the great variations in size and shape of the sinuses, and the variations in the distance behind the optic foramina at which the commissure is formed.

The frontal sinus, when of the supraorbital type and well developed dorsomedially, may have intimate topographic relationships with the optic nerve in the neighborhood of the optic foramen. Usually orbital fat separates the maxillary sinus from the optic nerve. Rarely, when the maxillary sinus pneumatizes beyond the confines of the maxilla into the orbital plate of the palate bone, and into the neighboring ethmoidal mass, it comes into contact with the optic nerve, thin bone alone intervening. The most dorsal of the anterior group of ethmoidal cells occasionally are a factor in optic neuritis. This is when the anterior group of cells encroach upon the more usual confines of the posterior group. It is not the topography of the ethmoid cells that determines the groups, but the location of the ostia of the cells in the nasal cavity; the anterior group draining into the nasal cavity caudal to the attached border of the middle nasal concha, and the posterior group cephalic.

Attention was called to the harm done by operating on the sinuses because no other cause for an optic neuritis could be found.

DEVELOPMENT OF OPTIC NERVE AND ITS RELATIONS TO EYEBALL.—Von Szily, in an article on the "comparative developmental history of the papilla of the optic nerve and the socalled axial structure," remarks that in all mammals examined, there is a primitive or epithelial optic disc, which is uniform in principle. The optic cup fissure has the task of preserving connection between the retina and the pedicle. A fold developing on the median end of the cup and on the groove which is a continuation of the cup pedicle, becomes constricted into a tube shaped closed structure, passing freely thru the visual ventricle; this is the embryonic rudiment of the primitive disc. To the intraocular connective tissue passing thru the fissure, the author ascribes primarily a function of regulating and inhibiting growth in the closure of the fissure and the forming of the disc, which is to a certain degree analogous with his interpretation in mammals, where the vessels serve, so to speak, as plastic masses, as a model for the tube shaped structure forming around them, the embryonic rudiment of the disc. The form of the disc, or the notch in the edge of the disc, is dependent, on one hand, on the total form of an eye at that time, and, on the other hand, on processes within the disc. This is of great importance in the genesis of malformations. As to the morphologic identity of the individual parts, the dorsal fold is common in mammals and birds; the oblong disc of birds corresponds to the ventral section of the tube shaped structure in mammals. The mammalian type represents a higher degree of development than the bird type, tho the latter is apparently more complicated.

Von Szily further writes on morphogenesis of the optic nerve insertion, and of the pecten in birds. His studies show, that while in mammals a fold is raised from the end of the fetal ocular cleft and becomes ventrally completely constricted off, forming a closed tubular connecting link between the retina and the optic pedicle, the rudiment of the "primitive optic nerve papilla," in the chick embryo the fold does not close ventrally, and an elongated papilla is formed. The mammalian type represents a higher stage of development, in spite of the apparently more complicated processes in the chick.

In a third paper, **von Szily** discusses the choroid fissure and development of the "primitive (epithelial) papilla of the optic nerve," with remarks on the bilateral or nasotemporal symmetry of the eye in vertebrates, and the socalled notches on the eye of the optic cup.

When investigations proved that the vitreous body originates in the main from the optic vesicle itself, and not from the connective tissue surrounding the hyaloid artery, the problem of the choroid fissure was again opened up. The formation of the optic cup begins in human embryos of 4.75 to 4.9 mm. length, and is completed when the embryo reaches a length of 5 mm. In embryos 8-9 mm. long, a partial closure of the choroid fissure has taken place. In 5 mm. embryos, the walls of the fissure are nearly parallel, the posterior diameter of the fissure being slightly narrower. It is traversed in its entire length by the hyaloid artery, which nearly fills out its lumen.

Another peculiarity of the rudimentary eye was first described by v. Szily in 1907, namely, the socalled notches at the edge of the optic cup. These notches appeared to prefer those localities where communication develops between the circular arteries and the blood vessels in the interior of the eye, The number of anastomosing branches between the edge of the optic cup and the equator of the lens is definite and limited. According to Rabl, a distinct bilateral or nasotemporal symmetry is noticeable early in the development of the eye in vertebrates.

Lindahl and **Jokl** write on the closing of the fetal ocular coloboma, the development of the point of insertion of the optic nerve, and the rudiments of the pecten in birds. Von Szily thinks the common interpretation of the theory of the significance of the optic cleft for admitting the inner ocular vessels, and for forming the tissue of the vitreous is quite questionable. He believes Rabl's theory significant, concerning the socalled bilateral or nasotemporal symmetry of the vertebrate eye, assigning a certain part to the optic cleft.

Bilateral symmetry is represented by 2 ridges, a nasal and a temporal; later on, by a vertical fold along the midline of the eye. The position of the fetal optic cleft is conditioned by the bilateral symmetry of the eye, for the cleft is too long merely to admit a vessel and some connective tissue to the vitreous space. V. Szily assumes that the real purpose for ridge formation and development of the optic cleft is to produce the optic papilla. The embryonic stage of transmissible colobomata shows: marked dilatation of the optic pedicle; retarded or abnormal closure of the optic cleft; duplication of entering vessels; wrinkling of the retina and involvement of pigment epithelium; abnormal course of central vessels; oblique insertion of the optic pedicle. Typical optic nerve fibers leaving the ocular rudiment, and extending partly thru the orbit, prove that the primary cause of this malformation must be looked for in the abnormal processes of transforming the optic vesicle into the optic cup, and in the subsequent development of the optic cleft.

Seefelder discusses the development of optic nerve entrance in the human subject.

In embryos 8-10 mm. long, the trunk of the optic nerve is distinctly marked off from the epithelium of the pigment coat; the ventral aspect of the trunk wall and retina gradually merge. The primary obliteration of the optic nerve cleft is not limited to the ventral fold of the optic nerve in the region of the pigmented epithelium; it also includes, a little further on, the proximal dorsal fold. In embryos 11-13 mm. long this obliteration of the cleft occurs, at the distal end of the optic nerve. The simultaneous expansion of the optic ventricle forces the optic nerve to grow longitudinally. This considerably long portion of the optic nerve, which runs thru the optic ventricle, represents the intercalary portion. Later, both optic ventricle and intercalary portion gradually shrink, while at the same time the nerve fibers grow thru the optic nerve. The place of the optic papilla is indicated by a funnel shaped depression, and its earlier stages may be demonstrated in the angular bend between nerve and retina, and in the differentiation of the layer of ganglionic cells outside of the papillary region. In embryos 17-20 mm. long, a very strong retinal fold is visible and extends from the optic nerve anteriorly to beyond the equator bulbi. Its location corresponds to the course of the former fetal optic cleft, and the fold arises shortly after obliteration of the cleft, probably because of persistently increased tendency to regional growth.

INVERSE TYPE OF DISC.—**Salus** has frequently observed the simultaneous occurrence of eczematous corneal spots and typus inversus, the anomaly of the papilla in which the first fork of the vessels points toward the nose, so that, in severe cases, the trunk of the central artery—sometimes also of the central vein—is visible for a greater distance than normally. The origin of the vessel lies at, or near, the temporal border of the excavation, which rises gradually toward the nose. If a conus is present, it is found at the nasal border of the papilla or is widest at this point. **Kraupa** points out that corneal maculae are common in myopic eyes, and both the opacities and myopia may be associated with the anomalies of the vessels.

A convincing finding was the unilateral coincidence of macula corneae and typus inversus, while the other eye was normal. On the other hand, typus inversus has not been frequently found in opacities following parenchymatous keratitis, or early injuries. Typus inversus, which according to Elschnig and Salzmann, is caused by the crooked entrance of the canal of the optic nerve, is, according to Fuchs, due to hypoplasia of the sclera and of the inner margin of the eye on the nasal side, and by traction by the shortened retina on the papilla. There are two possibilities: (1) that in typus inversus the eyes, being constitutionally inferior, are especially liable to eczematous keratitis, and (2) that the disturbance of vision due to the opacities, in the presence of congenital hypoplasia of the nasal portion of the ocular membranes, favors the occurrence of typus inversus. The author considers the first possibility the more probable one, since typus inversus does not occur in noneczematous corneal spots, and as, during a long course of treatment for macula corneae, no change was observed in the fundus.

ANOMALIES.—**Bane** saw a boy, ten years of age, having defective vision of the left eye since infancy. No cause other than a fall was elicited. V. O. D. 5/5, V. O.S. 6/60, sluggish light reaction of left pupil. The left disc was elevated 3 D., its margins concealed, and the blood vessels tortuous and atrophic. There was a large amount of fibrous tissue covering the disc.

Cunningham showed a case with *coloboma* of the optic nerve, which he thought was traumatic. The eye was myopic and without perception of light. There was no history of injury. In the discussion of this case, Hepburn thought the condition was of congenital origin, due to the absence of pigmentation and fibrous tissue. Mayou thought it might be due to birth injury, as there is not necessarily a mass of fibrous tissue in front of the disc following avulsion.

COLÓBOMAS.—**Randall** reported the case of a young woman, whose right eye presented a normal optic disc, having the usual vertically oval form. But the left showed a large horizontally oval disc, with a deep, central excavation with absorbtion crescents of the choroid at both lateral margins; each of which showed a "bottomless" depression sharply cut outward. The grandmother of this patient presented in her left eye, to the nasal side, a horizontally oval lesion of the choroid, that might have readily been mistaken for coloboma. But Randall had watched this develop from a patch of choroiditis, the vague yellow spot going on to atrophy with heaping of pigment at its margins.

In the case reported by **Van Duyse** as one of "fissure conus" and coloboma of the optic nerve entrance, the right eye presented a ring of sclera about the disc, and connective tissue bands extending upward and downward therefrom. In the left eye, there was a similar conus downward and an excavation at the lower margin of the disc, about which the retinal vessels emerge. Both eyes were microphthalmic. **Thorp** showed a boy of 5, in whom the anomalous condition of the optic disc and pigmentary changes in the adjoining retina could not with certainty be ascribed to faulty development or prenatal inflammation. In reporting a case of congenital coloboma situated in the center of the nerve head. **Feig** reviews the various theories to account for such anomalies, and points out their inadequacy to account for the phenomena.

Maxted presented a case of congenital coloboma of the disc, in a woman 25 years old. The whole of the right disc was involved in a congenital coloboma, the disc being about three times the size of the left one. There was a high hyperphoria, which was corrected by a prism of 7 degrees up before the left eye. **Roenne** reports a case of pseudoglaucomatous colobomatous excavation of the papilla, in a 39 year old woman. There were no symptoms of glaucoma. The intraocular tension was normal. The condition of the papilla remained stationary. There was also present congenital facial hemiatrophy. The papilla itself was surrounded by an area of atrophied choroid, which extended to the center of excavation in the form of a cone.

OPAQUE NERVE FIBERS.—**Bliedung** describes a case of extraordinarily extensive medullated nerve fibers that covered the entire papilla, excepting parts of the vessels. They proceeded in two broad wings toward the temple and, avoiding the macula, united again on the other side of the same. No such case of reunion is described in the literature on this subject. The field of vision showed a ring scotoma corresponding exactly to the form. According to the literature, cases of extraordinary extension nearly always show increased refraction and usually excessive myopia. In the present case, the vision was 1/50 with — 26 D. Extensive medullated nerve fibers are tokens of degeneration. In this patient, an hysteric attack was recorded. The apex of the right lung showed impaired reasonance and rough breathing. The right eye was somewhat painful on slight pressure and motion. The papilla was covered with distinct, whitish exudate. There was temporal bleeding, with retina clouded in the vicinity, and engorgement of the veins; the finger showed central scotoma at 1 m. Left eye normal. No reaction after injection of 0.2, 1.0, and 2.0 mg. of old tuberculin. Fever appeared only after 5.0 mg. given two days in succession, and the fever was then continuous. Bleeding disappeared on the third day, the exudate was in the process of being absorbed and the vision was 4/50 on the fourth day. The vision was 5/50 in three weeks, with no central scotoma. Papilla moderately hyperemic, its margin partially covered with radial stripes in all directions, with surrounding whitish figures arranged in a stellate form. Vision 5/15 after one month and 5/10 after two months, with disappearance of the white spots. The margins of the papilla are sharp and the macula slightly pigmented.

Lang reports a case of opaque nerve fibers. The field of vision showed a scotoma corresponding to the opaque area. The eye was myopic and amblyopic; with a — 3 D. sphere the visual acuity can be brought up to 6/60. (See also p. 284.)

PHYSIOLOGY.—**Taterka** made experiments on the optic nerve with intermittent Leduc current of low tension, like Richter's experiments on the acoustic nerve. Prolonged exposure to incoming and outgoing currents considerably increased the stimulation threshold of the optic nerve, that is, hypofunction of the nerve occurred. Taterka considers this process a partial functional defect of the central nervous system, due to Leduc electronarcosis. For a number of ocular diseases, Taterka thinks the application of the Leduc current is indicated. "The experimental results would seem to indicate that at least photophobia, painful ocular diseases and functional irritations might be favorably affected by the Leduc current." No experiments were thus far made with the human subject.

ETIOLOGY OF NEURITIS.—**Van der Hoeve,** considering the intimate relation of the *accessory sinuses of the nose* to the optic nerve, thinks it is a cause for wonder that there are people who never have eye disease of nasal origin. He finds that choked disc and papillitis, tho it is not always easy to differentiate one from the other, are relatively easy to recognize, because the ophthalmoscope reveals in the very beginning that something is amiss with the optic nerve. Diagnosis of atrophy is more difficult, at least in the beginning. But the greatest difficulty is caused by the most frequent condition, retrobulbar neuritis. Patients complain of pain behind the eyes, in the depth of the orbit, especially on movements of the eye. The ophthalmoscope is of only little aid; in the beginning we see either nothing abnormal or a little hypermia of the disc, dark and strongly filled veins. At last we find the characteristic pallor of the temporal quadrant of the disc; but, then it is too late. It is hoped, that in the lapse of time, examination of the light sense will aid in this matter. At present, the best indications are given by examination of the visual field. Here there are sometimes, as atypical symptoms, concentric contraction or annular scotoma; and as characteristic signs, central scotoma and enlargement of the blind spot. The first conclusion drawn, then, is that the ophthalmologist has in the eye no sign to distinguish the origin of a retrobulbar neuritis.

The rhinologists are agreed that the diagnosis of an existing sinus disease, especially of a posterior sinus disease, is not always easy, or possible. There is good support in the examination with Roentgen rays, but this is not infallible. In the presence of serious orbitoocular trouble, such as optic neuritis, the only satisfactory method of excluding suppuration of the sphenoidal and ethmoidal cells, is to operate and open them up. Otherwise, the rhinologist can not say with absolute certainty that a person has no sinus affection.

A diseased sinus may affect the nerve in the following ways: (1) By direct spreading of the inflammation. (2) By pressure from the walls of a dilated sinus. (3) By deleterious influence exercised by toxins, edema, and congestion. Two forms of optic nerve affection are distinguished; (a) reparable, which may exist for months and months, caused by toxins, edema, congestion, slight inflammation, or pressure, and (b) irreparable, due to degeneration and atrophy. Treatment should be begun in a conservative way: Many sinus diseases are cured with a cocain-adrenalin spray. Opening of the sinuses, even if nothing pathologic is found, may be of passing or permanent benefit to the optic nerve disease, due perhaps, to the bleeding, or change in the lymph currents. The question of operation must be influenced by the eye symptoms. The greatest difficulty lies in the chronic cases and there must be a very close cooperation between the ophthalmologist and the rhinologist to determine whether operation is to be done or not.

Redding, in a paper on optic neuritis following nasal accessory sinus disease, says: The first symptom complained of by the patient is dimness of vision in one eye, usually with the rapid onset and frequently without pain. With the ophthalmoscope, any change from slight blurring of the disc, papillitis, edema, or choked disc to optic atrophy may be found, the condition seen depending upon the duration and extent of the pathologic process. *Retrobulbar neuritis* shows no change in the nerve, the diagnosis being made from the other symptoms present. The perimetric findings are valuable if the patient is seen early enough in the course of the disease. The first finding is usually an enlargement of the blind spot. Later, with further involvement of the nerve, there is more and more contraction of the form and color fields. When central vision is lost, the perimeter is of little value. The X-ray should be used routinely. The main object of treatment is to relieve pressure on the nerve. In 8 cases presented, the usual causes of optic neuritis were not present. The sphenoid and ethmoid cells were found to be the primary seats of the trouble.

Beginning this work of aeration of posterior sinuses in optic neuritis some ten years ago, **White** was stimulated to continue it by the remarkable results obtained in early aeration of the sinuses on one hand, and on the other hand, by the pitiable and pathetic spectacles of permanent blindness which might have been prevented. He has had occasion to handle the cases referred from the ophthalmologic side, at the Massachusetts Charitable Eye and Ear Infirmary, for this condition, and so has been able to study a large number and follow them year by year. It has been possible to determine whether the lesion was peripheral or central. The writer gives as his opinion, that the optic nerve is only in close relationship to the sphenoid sinus and the posterior ethmoidal cell. In order to reach the tissue adjacent to it, the direct and logical route would be thru these structures and not thru the entire ethmoidal labyrinth. The diagnosis can sometimes be made almost from the symptoms, while at other times it can be determined only after the most careful and painstaking study. Roentgenograms are usually disappointing. No one etiologic condition is responsible for all cases. While purulent infections may account for a few, there are many in which the infection is nonsuppurative.

Poor ventilation and faulty drainage are all important predisposing factors. The size and position of the middle turbinates are of great importance in aeration of the posterior sinuses. The pathology is by: (1) Direct extension; (2) toxemia; (3) bacteriemia; (4) hyperplasia; (5) anaphylaxis. By direct extension, acute and subacute infections spread by continuity of structure to the optic nerve. Toxins originating in the accessory sinuses may involve the optic nerve. Microorganisms may be carried in the blood stream or lymph channels from the sinuses to the optic nerve. Hyperplasia is a predisposing factor, as tending to render the accessory sinuses more vulnerable. As to anaphylaxis, there seems to be a similarity between optic neuritis and certain anaphylactic reactions comparable to asthma and hay fever. As sinus infections cause asthma, it is conceivable that they might also produce engorgement about the optic nerve. Prognosis depends upon the duration and extent of the loss of vision, the condition of the fundus and the virulence of the infection.

Harry reports three cases of papillitis due to tonsillitis. The principal features of these cases were: intensity of the papillitis; completeness with which the papillitis cleared up; the unilateral character.

Stark writes of retrobulbar neuritis, secondary to diseases of the nasal sinuses. He says: Retrobulbar neuritis is probably due to disease of the nasal sinuses. The pathology is based on the infection of one or more of the nasal sinuses, usually the posterior, with interference with drainage thru the natural opening. There may be very mild types of this disease, or types severe enough to cause an orbital abscess or meningitis. The diagnosis is made from the eye symptoms and nose pathology. The important points in diagnosis are central scotoma for color, enlargement of the blind spot, exophthalmos, interference with the action of the extraocular muscles, and interference with the pupil, particularly if sudden. One should not expect to find common symptoms of sinus infection, pus, polypus, nasal discharge, etc., for this is a closed sinus. The deflected septum and middle turbinate tightly pressed against the lateral wall should always be suspected. Both transillumination and roentgenography should be used. Two cases are reported, in one of which a syphilitic involvement of one of the posterior sinuses was the probable cause of trouble. Preliminary nasal, teeth, Wassermann and neurologic examinations are followed by investigation of the nasal sinuses, and treatment with the suction apparatus. Improvement indicates continued treatment; no improvement indicates an early operation, as otherwise there will be great danger of permanent injury to the optic nerve. First relieve the pressure, with as little damage to the nose as possible, by operating on the middle turbinate; later open the suspected sinuses. Blindness may result from a sinus infection.

Mendoza writes on blindness produced by disease of the sphenoidal sinus. During an experience of 30,000 eye cases in seven years, he has seen 30 cases. In some of these the ophthalmoscope revealed a postneuritic atrophy, in some exophthalmus; some patients complained of intense and constant headache, and some were in a state of such excitement that they were like persons attacked by acute mania. Whenever a sudden unaccountable disturbance of vision arises, suppuration of the sphenoid fossa and the posterior ethmoid cells should be suspected. At the outset, the oculist observes a central scotoma of one or both eyes, with nothing abnormal in the fundus. All the postneuritic, exophthalmic or edematous symptoms, and pain on pressure appear later, and represent a concomitant cellulitis or periostitis. The mere presence of the central scotoma should be an indication to search for sinuitis without loss of time.

Bordley emphasizes the importance of thoro painstaking investigations before concluding that a given disturbance in the fundus of the optic nerve is or is not based upon disease of the paranasal cells. There is no definite knowledge of any ocular manifestation which is peculiar to sinuitis. Coincidence of one disturbance with the other does not justify the assumption that the one is dependent upon the other. A radiographer mistook an occipital ridge for pus in the antrum. The real condition was choked discs resulting from a cerebral tumor. In 102 cases of sinus disease, only 31 had an enlargement of the *blind spot,* tho this is one of the most common symptoms in alterations of the visual fields. The usual picture in his experience is that of a dimness or haziness of the margin of the disc, explained by venous stasis, there being thru the orbital veins a direct communication between the veins of the sinuses and the cilioretinal system, these veins being valveless.

Haziness of the disc margins is by no means pathognomonic of sinus disease; any cause which has a depressing effect on the orbital circulation may result in obscuration of the margins of the disc. The ophthalmoscopic change may pass beyond simple congestion and manifest itself as a pure neuritis, a retrobulbar neuritis or a choked disc. In the author's cases, inflammatory neuritis was more frequently met with in patients in early adult life and in association with moderately acute nasal symptoms; retrobulbar neuritis with its typical ophthalmoscopic picture occurred in the more chronic types of sinuitis, and he has come to regard choked disc as an indication of secondary meningeal disturbance. The author has observed only four cases of choked disc, in three of which there were post-mortem evidences of extension of the disease to the meninges.

Cheval and **Coppez**, in discussing lesions of the optic nerve due to sphenoidal and parasphenoidal changes, observe, that 35 to 40 per cent of retrobulbar neuritis develop following accessory sinus disease. Besides acute purulent accessory sinus affections requiring immediate operation, retrobulbar neuritis is usually due to the lingering and latent types. Neuritis localized within the orbit causes visual field defects, either concentric or sectional limitation, according as it is perineuritis or transverse neuritis. Neuritis of the tract is usually due to compression of the optic nerve, particularly of the papillomacular bundle (enlarged blind spot; Van der Hoeve, paracentral scotomata, "neuritis axialis"). In every such case, Cheval and Coppez recommend radical procedure, even tho X-ray findings prove negative.

Stella has discussed optic neuritis from hypophyseal, sphenoidal and ethmoidal lesions.

Mellinghoff, in a paper on optic neuritis during lactation, discusses in detail the different etiologic possibilities, such as myelitis, cold, multiple sclerosis, etc. *Lactation* may, as a result of intoxication, be a sole or a contributing cause, as exogenous and endogenous toxins (gout, diabetes) may injure the optic nerves. A toxic action on nerves is also assumed in polyneuritis, myelitis and multiple sclerosis. In the author's case, the injurious effects of lactation were the most probable cause. They are to be regarded as caused by the rapid catabolism of albumin during lactation. It is easiest for them to exercise their injurious action on the sensitive optic nerve, when the natural resistance of the body is decreased by those anomalies in metabolism which takes place during pregnancy, the puerperium and lactation. Cold, serious losses of blood and changed composition of the blood have a weakening effect, and therefore tend to favor the formation and action of endogenous toxins.

Burnford reports a case of optic neuritis with *anemia.* The patient was a married woman, aged 24. Three months previously, after her second confinement, she noticed that her sight was beginning to fail, and suffered from severe headaches. The ophthalmologist reported double optic neuritis with swelling about 2 D., much exudation, particularly along lines of vessels; patches in the macular region; characters are those of vascular disease. The blood showed an anemia of the chlorotic type. The Wassermann reaction was negative.

Treated with iron and arsenic in increasing doses, she remained in bed for nearly three months and steadily improved. The neuritis subsided, the discs became distinct, and at the time of her discharge from hospital, there remained only some white spots in each retina, with an aggregation around the macula simulating the appearance in albuminuric retinitis. At the time of her discharge, she could read and do fine needlework.

Waardenburg, in writing on the optic nerve in *epidemic encephalitis*, noted ring scotoma in one case and slight restriction of the peripheral visual field in the second case, along with paralysis of accommodation or convergence, anisocoria, transient immobility of the pupils, and disturbance in the associated movements of the eyes.

Tornatola observed 29 cases of *polioencephalitis* with neuropapillitis. Five of these case reports he has published. In some cases, the preliminary diagnosis was made of cerebral tumor, and Tornatola cautions against this mistake because of the utterly different prognosis.

Fromaget reports a case of diphtheritic optic neuritis in a man of 42. He had pharyngeal *diphtheria* on Dec. 12. At the end of December, there was paralysis of the palate. In the next month, ocular trouble began with diminution in visual power, and retro-ocular pain after movement of or pressure on the eyes. The eyegrounds were edematous, the disc margin had disappeared; the veins were very voluminous and tortuous. Antidiphtheritic serum was given, all of the signs clearing up after two weeks of serotherapy.

Autopsy findings in 12 cases of *adiposis dolorosa* showed certain changes of the thyroid gland. In over one-half of the cases, changes were also observed in the hypophysis, suggesting disturbances of internal secretions. The etiology of Dercum's disease is not fully understood as yet. **Behr** reports 3 cases where there was optic neuritis. Both ocular symptoms and the effects from organotherapy were so striking, that Behr believes they may throw light on the etiology of the problem. Case 1. A male, 52 years old; ocular findings: bilateral temporal fading; in right eye a relatively large paracentral scotoma, in left eye enlarged blind spot. Under hypophysin medication, the central scotoma rapidly decreased and finally disappeared completely. Visual acuity increased gradually to 7/8 and 7/12; nodular growth was checked and no new nodes formed. Improvement has continued for 3 years. Case 2 was a male, 54 years old. Ocular findings: Left eye complete optic atrophy; temporal fading in right eye. Under mixed thymus, thyroidin, hypophysin and testine medication, optic conditions remained stationary but the adiposity markedly increased. Case 3 was a woman, 57 years old. Ocular findings: Right eye normal, left eye optic neuritis with hemorrhages in the macula; treatment: not mentioned. Behr thinks optic neuritis is an actual symptom of Dercum's disease.

Mason reports a case of optic neuritis in *serum sickness,* in which certain abnormalities were found pointing to involvement of the central nervous system in the reaction of the organism to a foreign serum. A well marked, bilateral optic neuritis was observed, associated with marked lethargy and an increase of the globulin and cellular content of the cerebrospinal fluid. There were no demonstrable visual disturbances. At the end of three months the fundi had become normal.

No similar case was found in literature, but, later, 2 cases came under the writer's observation, in a child with epidemic cerebrospinal meningitis and a woman with acute lobar pneumonia following delivery. In each instance the urine was normal, and it is improbable that the optic neuritis was dependent on renal impairment or was produced as a result of the general infection.

Hannah, writing on optic neuritis in serum sickness, was impressed with the quantity of serum (500 cc. within four days) administered intravenously. His observations have indicated that the frequency and degree of foreign protein reactions are in proportion to the quantity (within certain limits) of protein injected. The method of injection also influences reactions, the intravenous route affording more rapid and in some degree severer manifestations than the intramuscular or subcutaneous route.

TREATMENT OF OPTIC NEURITIS.—**Avalos,** discussing the indications and contraindications of *salvarsan* and of neosalvarsan in ocular therapeutics, says salvarsan has its advantages when we diagnose an optic neuritis at its beginning. There are no contraindications in disturbances of the conjunctiva, cornea, sclera, iris, or ciliary processes. Contraindications exist only in certain stages of optic neuritis and in atrophy of the optic nerve. When neuritis is in full efflorescence, either arsenic or mercuric treatment is dinfinitely harmful. A nerve of such sensibility as the optic shares in the reaction, with resultant amblyopia or even amaurosis. Injections are perfectly indicated at the beginning of neuritis, but only then.

Marin Amat, writes of intraocular neuritis, or monolateral papillitis with total amaurosis, cured by parenteral injections of sterilized milk. The patient was a woman of 44. The intense, unilateral, intraocular optic neuritis with total amaurosis developed suddenly, as a complication of sphenoidal sinuitis.

Cocain to the nasal mucosa and inhalation of menthol, plus seven subcutaneous *injections* of 4 c.c. of *milk* in the course of eleven days, restored vision to normal, with subsidence of all the ocular symptoms.

Retrobulbar Neuritis.—**Stark** says the pathology of sinus disease retrobulbar neuritis is not well understood, as these cases seldom come to postmortem. The simplest symptom complex is that of monocular impairment of vision, combined with central color scotoma with a normal fundus. Optic neuritis, choked disc or paling of the disc, enlargement of the blind spot, central or paracentral scotoma for white and color, and contraction of the visual field occur. One or both eyes may be involved. He thinks the condition due to pressure. In making the differential diagnosis, hysteria, intracranial disease anterior to the chiasma, amblyopia from other causes including tobacco, alcohol, pellagra, brain tumor, syphilis and insular sclerosis must be considered. He treats all acute cases with sinus suction; if no improvement, sinus operation is advised, tho the nasal findings be negative. Relieve pressure first by operating on the middle turbinate; if this is not successful the sinuses are opened.

Jervey reports a case of monocular retrobulbar optic neuritis caused by purulent maxillary sinuitis, stating that he knows of but two cases of optic neuritis due to septic disease of the maxillary sinus reported in the literature.

A girl, aged 16, came to an oculist complaining of styes. High hyperopic astigmatism was found, with vision 20/40 in the right eye and only counting fingers in the left. Diseased tonsils were discovered and tonsillectomy advised. A short time after, she had only 20/200 in the right and light perception in the left eye. The field was severely contracted in the right, to only 5° in the upper and nasal fields, with about 20° in the lower field and 10° to the temporal side. The vision of the left did not permit charting the field. The ophthalmoscope showed normal eyegrounds, with all the media clear. There was noticeable tenderness over the right maxillary antrum, and radiographs showed a faint cloudiness of this sinus. Transillumination revealed cloudiness in this area. The right middle turbinate was cystic, but there was no nasal discharge.

The right middle turbinate was resected and the ethmoid and sphenoid cells opened up without finding any disease. The nasoantral wall was then opened and the antrum irrigated, a large quantity of pus being evacuated. Within two months the vision of the right eye had returned to normal.

Reeder says the differential diagnosis between nasal retrobulbar neuritis and other forms may be easy, difficult or impossible. The grouping of the etiologic factors under five headings should be of some assistance.

1. Toxic amblyopia. The history and the small, typical oval shaped scotoma are diagnostic. 2. Cases with definite nasal symptoms combined with signs of orbital involvement—headache, exophthalmos, edema of the conjunctiva and lids, paresis and muscular asthenopia, combined with an enlarged blind spot. 3. Cases showing other cardinal symptoms of multiple sclerosis. 4. Cases giving a definite history of heredity, injury, tower skull, lues, hemorrhage, acute infection. 5. No etiologic factor apparent—apt to be either multiple sclerosis or nasal in origin.

Retrobulbar neuritis is a rare disease. Cases of nasal etiology probably comprise less than 10 per cent of the total. The most constant eye finding is a central scotoma. In cases of nasal etiology, deep hyperplastic ethmosphenoidal disease is usually present. These cases usually show definite symptoms of nasal disease, with signs of orbital involvement and probably an enlarged blind spot. In cases of obscure etiology, one is justified in advising an exploratory nasal operation.

Gallaher, in discussion of the nasal status in retrobulbar optic neuritis, says: Once the diagnosis of retrobulbar neuritis is made, the rhinologist should be consulted and the proper operative nasal procedure instituted immediately.

No pathologic condition can be demonstrated in the nose; it is entirely justifiable to open the posterior ethmoids and sphenoid. It is better to sacrifice the middle turbinate and ethmoid cells than to jeopardize the patient's vision. The case histories of 4 patients are given to demonstrate the good ocular effects secured by operation for hyperplastic, nonsuppurative nasal conditions.

Beck says 91 cases of empyema of the *nasal accessory sinuses* were examined concerning associated optic findings. In 6 cases only, positive optic findings were observed. These were unimportant for diagnostic purposes except in case 3, where left retrobulbar optic neuritis with a positive Wassermann clearly indicated the onset of *tabes*. Beck states that optic findings do not justify the conclusion that retrobulbar neuritis is due to empyema of the nasal accessory sinuses.

Archer-Hall reports a case of bilatal retrobulbar neuritis in a 22 year old woman, first seen June 6, 1921, complaining of loss of vision in the right eye and headache for six days. Visual acuity was perception of light. With the left eye she had vision of 6/12. Ophthalmoscopically, there was found slight optic neuritis, not sufficient to account for the blindness. The blindness seemed due to an inflammation of the optic nerve posterior to the eye, but extending anteriorly so that slight inflammation could be detected ophthalmoscopically at the disc, apparently due to toxemia from some septic focus. Extraction of what appeared to be the only carious tooth was advised. Seven days later the patient was blind in both eyes, altho the tooth had been removed. The *teeth* were then roentgenographed; the left upper first bicuspid showed a shadow suggesting rarefaction and the crown of the tooth was carious. Two other teeth were very tender and loose (the upper left second bicuspid and the lower right first molar). There was slight gingivitis in the area of the lower incisors, due to calculus. The two upper left bicuspids and the lower right first molar were extracted. The lower incisors were scaled and the gingivitis soon cleared up. Twenty-four hours after the extraction, the patient felt better; vision amounted to the counting of fingers at 1 meter. Eight days after removal of the three teeth, she saw the largest letter at 6/60. She had attained full fields of vision and perfect acuity with each eye.

St. Martin writes of a clear case of the dental origin of retrobulbar neuritis in a woman of 27, who consulted him because of rapid loss of sight in the left eye. Her general health was good. Ten days previously, she had noticed a slight haziness on the left side and this had increased alarmingly. Examination of the eye was negative, but it was noticed that pressure on the eyeball caused a severe pain in the back of the left eye. Examination of the visual field of the left eye showed the presence of a vast central scotoma, relative for white and absolute for colors, a condition characteristic of retrobulbar neuritis. Careful search for a focus of infection as well as for evidence of any systemic disease resulted in the discovery that the two left premolars had infected roots. The removal of these was followed by immediate improvement, terminating in normal vision at the end of two weeks.

The correlation of *ear* findings and retrobulbar neuritis is reviewed by **Ruttlin** in the light of 25 positive findings. Women were more often affected than men. There are almost no findings below the age of 20. There was a cochlear lesion in 20 cases. Evidently both the auditory and the optic nerve were attacked by the same cause—toxin, infection or trauma. Disease of the vestibular nerve is to be similarly explained. The concurrence of a retrobulbar neuritis with disease of the cochlear or vestibular nerve would speak in favor of a toxic rather than a nasal cause.

Retrobulbar neuritis occurring with evidences of *hypophyseal disease* in young persons is the subject of a paper by **Munoz Urra.** This is important on account of the need to recognize the cause and apply the appropriate endocrin therapy.

Sattler reports a case of retrobulbar neuritis with early symptoms of *exophthalmic goitre.* Man of 57; examined 5 years previously and eyes found normal, present condition retrobulbar neuritis with *central scotoma* for colors; neurologic and X-ray findings normal; Wassermann, negative; some emaciation. Tobacco was forbidden, but under iodin medication, visual acuity slowly decreased; 16 months after first examination, symptoms of Basedow's disease appeared; exophthalmus 22 mm.; rapid pulse; Graefe, Dalrymple, Stellwag, Moebius signs and finally Loewi tests positive. Increase in size of neck; increase of exophthalmus to 28 mm.; palpitation of the heart. After unilateral strumectomy, these phenomena disappeared, visual acuity improved from 1/16 and 1/20, to six months later 1/2 and 1/6 with good general condition; the outer papillary temporal halves remained as pale as at the climax of the disease. Anatomically, the struma contained remarkably large, partly colloidal follicles, and some portions of the gland were distinctly diseased.

Hird reports a case of acute retrobulbar neuritis. The patient was a male, aged 21 years, who complained of sudden loss of sight in his left eye, vision being perception of light only. The pupil reacted consensually only, there being no response directly to light. The optic disc appeared to be a little congested. The field showed a very large central scotoma, which was absolute, and extended to the periphery, the white field being horseshoe shaped. The right eye was normal, except for myopic astigmatism, and vision was 6/12 with correction. The pupil did not react consensually to light.

No nasal sinuitis was found. A Wassermann test was negative. X-ray photograph of orbit showed nothing abnormal, and no cause could be found for the condition. Three days later, definite optic neuritis with vision improved to counting fingers. The scotoma was less. After two weeks, the optic neuritis almost gone and vision 6/18 partly, with correction for myopic astigmatism. The absolute scotoma had disappeared, but there was a small relative scotoma.

Armstrong reports a case of retrobulbar neuritis with symptoms of disseminated *sclerosis.* The patient, aged 35 years, stoker at a gas works, came complaining of failure of sight in the left eye for the past fortnight. Ophthalmoscopic examination revealed the disc much obscured, the margin barely visible. Pressure on both globes, especially the left, caused great pain. He also complained of considerable heaviness of the lower limbs. The knee-jerks were greatly exaggerated.

Reis says the most familiar among the *toxic amblyopias* caused by the nitrated coaltar derivatives are those resulting from *dinitrobenzol,* which were very frequently observed among munition workers during the war. He reports the case of a munition worker injured by a grenade explosion, who gradually developed an optic nerve atrophy. This was interpreted as one of the manifestations of disease of the central nervous system resulting from injury. The author, however, believes that it is a typical case of toxic amblyopia, chronic retrobulbar neuritis, from trinitrotoluol poisoning, since the patient had handled that explosive for about fifty months in a munition factory, and trinitrotoluol is closely related in its chemical composition to dinitrobenzol, well known as an optic nerve poison. It is the author's opinion, that under certain conditions grave toxic effects on the optic nerve may be produced by it. He is supported in his opinion by a second case of optic nerve atrophy, which has come under observation in the meantime. This man had also worked for a long time in a trinitrotoluol factory, and the expert opinion of the ophthalmologist (Cords) pronounced the case as probably in causal relation with his occupation in the factory, since the most painstaking examination had failed to disclose any other cause for the optic nerve disease.

Scheerer, in reporting a case of so-called *fulminating blindness* in a child, says it attacks chiefly children; the fundus is normal or the nerve is inflamed. No treatment avails; pupillary reaction and visual acuity reappear after some weeks.

Strebel writes upon retrobulbar neuritis connected with *influenza, diabetes* and the cachexia of carcinoma; and **Schmeichler** on acute retrobulbar neuritis. **Kafka** saw a case of bilateral optic neuritis in which one nerve recovered, but the other went on to atrophy with *glaucomatous excavation.*

PAPILLEDEMA.—**Krauss,** in a paper on ophthalmosurgical experiences in wounds of the skull, says of the 218 cases of shot wound of the head operated on, the bones of the skull were not injured in 110, and were more or less badly broken up in 108. The optic papilla was affected in 14 of the first group, ten with choked disc, four with papillitis. Operative measures, in the form of lumbar puncture, were required in three cases, all of which recovered. All of the cases in the second group had to be operated on as quickly as possible. Only 45 of the 108 exhibited permanently normal conditions of the papilla. There were 14 cases of choked disc, 41 of papillitis; the former usually with uninjured, the latter always with injured dura. Almost a third of the second group died within twelve days, mostly from purulent encephalitis or meningitis.

The writer believes, that after a penetrating wound of the skull, the patient should be kept under ophthalmologic observation for at least two weeks. Swelling of the papilla two or three days after the injury he considers a symptom of a complication, and to be of unfavorable prognostic import, while papillary signs appearing later, he thinks distinctly threatening. Every shot wound of the skull should be looked upon as infected, and surgical measures should be taken from this point of view, to do away with the primary infection and prevent complications.

Jocqs presents a study of the mechanism of lesions of the fundus of the eye produced by intraorbital projectiles.

Bennett reports a case of swelling of the optic disc occurring in an alcoholic. He may have taken wood alcohol; there was delirium, following and both discs were swollen 5 D. A spinal puncture was done and two ounces of fluid removed under great pressure. Tapping was done daily. The discs rapidly became normal and his vision improved.

Black says the eye findings with brain injuries studied in conjunction with the general symptoms are important in estimating the extent of the injury, in aiding in localization and treatment. Their manifestations may result from increased cranial pressure, actual destruction of, or injury to the cortical visual centers or tracts, or from meningitis or infections.

Thrane says: Optic neuritis may be absent in all kinds of intracranial complications, but may be present in all of them, altho very rarely in such diseases as epiphlebitis and perisinus abscess, pachymeningitis and epidural abscess. On the other hand, cerebral abscess, subdural abscess, meningitis and thrombophlebitis, whether appearing isolated or combined as complications of a middle ear inflammation, are of great significance in the etiology of retinal changes. Great diagnostic value seems to belong to optic neuritis only when it is present in seemingly uncomplicated cases of otitis media. It gives no indication with regard to the character or the localization of the intracranial complication.

Thrane found in 15 years records of the Municipal Hospital at Copenhagen: Meningitis, 36 cases with 12 of optic neuritis. Thrombophlebitis, 47 cases with 10 of optic neuritis. Cerebral abscess, 1 case; subdural abscess, 2 cases, without optic neuritis. Meningitis and thrombophlebitis, 14 cases with 4 of optic neuritis. Meningitis and cerebral abscess, 16 cases with 4 of optic neuritis. Meningitis and subdural abscess with none of optic neuritis. Thrombophlebitis and cerebral abscess, 3 cases all with optic neuritis. Thrombophlebitis and subdural abscess, 1 case with optic neuritis. Meningitis, thrombophlebitis and cerebral abscess, 11 cases with 5 of optic neuritis. Meningitis, thrombophlebitis and subdural abscess, 2 cases with 1 of optic neuritis. Meningitis, cerebral abscess and subdural abscess, 2 cases with none of optic neuritis. Meningitis, thrombophlebitis, cerebral abscess and subdural abscess; 5 cases with 2 of optic neuritis. Solitary, in all; 86 cases with 22 of optic neuritis. Multiple, in all; 57 cases with 20 of optic neuritis.

The character of the changes shows a marked difference in cases of meningitis and thrombophlebitis. With meningitis it is especially the first and second grades of optic neuritis which occur, whereas with thrombophlebitis it is the third grade which is most frequent. The reason may be that in meningitis there is no time to reach the aggravated retinal changes.

As to localization, optic neuritis was found in 5 cases of meningitis; first or exclusively on the side of the affected ear, in 5 other cases equally on both sides; in no case was optic neuritis first found on the side of the normal eye. With thrombophlebitis, there was one case of bilateral optic neuritis, most pronounced on the side of the normal ear; but the ophthalmoscopic changes always appeared first and were most pronounced on the side where there was an ear affection.

As to the time for appearance of the neuritis in cases of uncomplicated meningitis, the ophthalmoscopic changes were observed, some on the second day of the illness, others on the third, and so forth up to the seventh day. Ophthalmoscopic examinations first made after the seventh day, all showed normal retinas. In connection with thrombophlebitis, the neuritis was observed in 1 case on the same day on which the disease manifested itself clinically, in the other cases at different stages, even so late as on the 20th day.

It appears that the optic neuritis is twice as frequent with acute chronic otitis. The author's material gives no support for the assumption that certain forms of bacteria will, with special frequency, cause neuritis. The inferences that can be drawn for the prognosis from the presence or absence of optic neuritis are uncertain, but the author is inclined to regard it as a favorable sign rather than the opposite.

Schmiegelow has found papilledema with mastoiditis, without symptoms of intracranial disease.

Dabney, in a paper on ocular symptoms of brain tumor, observes that it has been said that choked disc has no value in the localization of brain tumor. It often happens that the tumor is not on the side of the eye first affected, as it was supposed by Horsley to be. In a case treated by the author, a patient seeking relief from disturbance of vision, headaches and fainting spells had a vision of 20/20 in each eye, well marked neuritis in both eyes, and a right sided homonymous hemianopsia. A large tumor was removed from the left side of the brain, with perfect recovery. Direct vision may be perfect, with marked ophthalmoscopic changes. In 2 patients with bilateral optic neuritis, who came to consultation for relief of headache, one, a girl of 13 years of age, was operated on for brain tumor and died; the other, a woman, refused operation and died of brain tumor. **Hansell** reports a case of cerebral tumor with double choked disc.

Sidler-Huguenin, after discussing the few cases of choked disc in *tetany* in the literature, reports the case of a female patient, who after 2 goiter operations had tetany with severe bilateral choked disc, and later partial cataract and iridocyclitis with secondary glaucoma. After implantation of parathyroids, there was temporary improvement and after 15 days death. Histologically, there was marked swelling of the disc without inflammation. **Von Hippel** criticises the view of Sidler-Huguenin, that choked disc may be produced by inflammations and intoxications apart from increased intracranial pressure.

Mathewson, reporting a case of rare intracranial tumor in a little girl, says, ophthalmoscopic examination showed optic neuritis, and later commencing atrophy in the left fundus, slight optic neuritis in the right. Symptoms pointed to the presence of an intracranial tumor.

When the skull was opened postmortem, the base of the brain was found to be resting upon a large, thin walled cyst, which contained about 120 c.c. of straw colored fluid. The wall of the cyst was continuous with the soft tissue of a new growth, hanging down into the interpeduncular space and apparently replacing the infundibulum and tuber cinereum.

The left caudate nucleus and lenticular nucleus and the anterior limb of the left internal capsule, as far posteriorly as the genu, were imperfectly developed. The thalamus was dislocated. The optic chiasm was compressed.

Calderwood, in writing of white spot disease of salmon causing blindness, says the severe drought of summer has caused the appearance of this disease.

Roenne reports the case of a 50 year old man with double choked disc, early amaurosis and general cerebral symptoms, who died 3 weeks after he was attacked. Autopsy showed a hemorrhagic *myelitis* with involvement of the chiasm and optic nerves.

Kennedy reports five cases of acute benign *encephalitis* with papilledema, because they have many factors in common. The patients all had evidence of systemic infection, as shown by changed blood pressure, fever and general malaise.

The onset was acute, in some cases sudden, with headache. In all, a period of stupor was followed by one of excitement or disorientation, to be followed later by focal cerebral palsy, hemiplegia, hemianopia, aphasia or cranial nerve inadequacy. The rapid onset of optic neuritis late in the illness, with amelioration of previous symptoms, and its rapid amelioration in turn must depend on sudden blockings and restorations of intraventricular drainage.

The fundi of one case—normal on admission—were covered two days later with hemorrhages, and the papillae were invisible thru swelling. On this day she had severe left parietal headache; she vomited and was restless and uneasy. Lumbar puncture showed a fluid under increased pressure, of a light yellow color, thicker than usual and containing 20 lymphocytes.

Papilledema was at its height in three days from its inception; it then rapidly retrogressed and in ten days no swelling could be made out. In three weeks all trace of the hemorrhages had also disappeared. This patient, fifteen months after her illness, was normal, except for a spastic cerebral paresis of the right lower extremity.

TREATMENT OF PAPILLEDEMA.—**Kubik** considers Müller's operation as the least dangerous procedure: in cases in which operation for a tumor of the brain has been refused; in which the neurologic findings do not account for a cerebral origin of the choked disc; and in which a palliative cranial operation does not control the choked disc or favorably influence vision. The operation is performed under general anesthesia, the external plate of the orbit being resected, a ligature passed around the rectus externus and the muscle drawn forward, by which manipulation the optic nerve is put under tension. A quadrangular section of the nerve sheath, 3-4 mm. wide and 8-10 mm. long, is then removed from the superior surface by means of a Graefe knife. Thru this opening the fluid escapes, sometimes under considerable pressure.

Collin reports a rare brain tumor in a patient, 38 years old, for several years afflicted with headache and vertigo. No initial localized symptoms, only bilateral meningitis of the optic nerve with normal functioning. Gradual development of choked disc, earlier and more severe in left eye than in right. Two months later, left hemianopia developed simultaneously with slight exophthalmus of right eye, with symptoms of lid congestion. Neurologic diagnosis: progressive tumor growth in right posterior cranial fossa. At operation a tumor as large as a fist was found in right posterior occipital lobe (endothelioma of dura). A year and a half after the operation, the patient was discharged as clinically recovered. Visual acuity perfect. Visual fields almost normal.

Bourgüet reports a second case of *puncture of the corpus callosum.* In the first case, complete disappearance of the papillary stasis with restitution of vision resulted. It was not an instance of intracranial tumor. In this second case, a complete disappearance of the papillary stasis was also effected; but vision was not restored for optic atrophy ensued. Puncture of the corpus callosum was done May 14, 1920; compression of the optic nerve was relieved, the headache and other symptoms ceased. Under a local anesthetic, the operation proceeded with incision near median line to the right of the bregma, a drill trephine opening was made of the dura mater, which did not pulsate. The canula was introduced along the falx into the ventricle. As soon as the corpus callosum was traversed, and the mandrin withdrawn, the cerebrospinal fluid jetted out under pressure to about 2 m. distance. A test tube was immediately filled for analysis. Altogether about 60 c.c. of fluid was removed Pulsation immediately recurred. The following day, complete relief from all symptoms was obtained. On the eighteenth day, ophthalmologic examination showed disappearance of papillary stasis.

Vision, however, did not increase. The writer considers that whenever a papillary stasis is to be dealt with, the ventricles should be relieved, by puncture thru the corpus callosum, of the intraventricular fluid, the cause of the stasis, which in a large proportion of cases will restore vision. He also believes that puncture in the case of tumor with stasis, makes removal of the growth easier by relieving the intraventricular pressure, which otherwise leads to cerebral hernia.

Marburg reports the results of Müller's method of draining the optic nerve sheath. Müller reported successful results with this method in 19 cases —mostly tumors. In Purtscher's cases operated on by Müller's method, the choking disc regressed, altho the patients had already been blind and their optic nerves atrophied before the operations had been undertaken.

Marburg had occasion to study personally 5 cases which had been operated on by Müller or his assistants. As far as vision was concerned, trepanation of the optic nerve, in these cases, yielded no results whatever. As a matter of fact, the cases which he had an opportunity to examine anatomically showed evidences of grave injury to the optic nerve, and instead of permanent drainage, which the operation is supposed to accomplish, there was an increase of the choking of the disc. In 2 cases the operation was followed by a keratitis, which rapidly became purulent. While it is true that both of these cases were tumors near the trigeminus, nevertheless, the keratitis in both cases must be attributed to the operation, because in one the symptoms of corneal involvement prior to operation were almost insignificant, while in the second case there were no corneal symptoms at all prior to operation. Marburg is, therefore, inclined to agree with v. Hippel that *Müller's operation* of optic nerve sheath trepanation is by no means a harmless procedure, and that it presents no advantages over decompressive operations, and should never be considered in cases in which the choking of the disc is due to a lesion in the posterior cranial fossa.

ATROPHY WITH CRANIAL DEFORMITY. —**Xilo** reports a case of pathologic cranial *synostosis* with serious changes, in which the left eye showed complete atrophy of the papilla of the optic nerve, and almost complete loss of vision in the right eye, signs of papillitis, reduced vision and slight exophthalmos. The child underwent cranioresection. Two months after operation, the right papilla was somewhat hazy in outlines and greyish white in color; the visual field extended 50° outward. The condition continued to improve.

Mehner, in an article on ocular changes in cranial deformities, reports 14 cases of his own, and 17 other cases, of *tower skull;* of the 21 cases, 6 failed to reveal ocular disturbances. Of the 21 cases, in 12 there was bilateral neuritic atrophy of the optic nerve, in 2 simple atrophy. In the 15 cases with ocular disturbances, horizontal nystagmus occurred in 6; spasms occurring in the terminal position, resembling nystagmus, were observed in 3 cases. The visual acuity varied from amaurosis to 6/6. For the treatment of the condition, the author recommends craniectomy or extirpation of the synostosed sutures, as the methods most in keeping with the etiology.

Marin Amat reports a case of optic atrophy with *oxycephaly.* A new born girl child presented a large tumor mass on the skull. The pedicle was ligated and the mass excised, evacuating a quantity of blood and cerebrospinal fluid. Five months later, the child could not see and was quite apathetic. The child's cranium was extremely small; the frontal, parietal and occipital eminences were lacking. The occipitomental diameter was exaggerated, and by radiography, the frontal sinuses and sella turcica were seen to be very large. There existed double optic atrophy due to narrowing of the passage of the optic nerve. An encephalocele, which probably acted as a safety valve, was present on the vertex of the skull. The child survived for three years, altho completely idiotic.

HEREDITARY OPTIC ATROPHY.—**Morlet** discusses hereditary optic atrophy as a possible menace to the community. The disease develops around the twentieth year as a retrobulbar neuritis. A previously healthy and normal individual is suddenly stricken with defective eyesight. Without any warning, vision becomes misty, colors cannot be distinguished, and within two or three weeks the unfortunate patient may have to be led about. For several weeks after the onset, no ophthalmoscopic change may be detected, altho sometimes slight indications of optic neuritis become evident quite early. Before very long, however, evidence of commencing atrophy, often at first only in the temporal quadrant, becomes apparent. It is now found that the visual defect has assumed the form of a very large and very intense central scotoma, which blots out all central vision from each eye, while the hazy and shadowy sight which is derived from the periphery of the retina is little interfered with. Total blindness never ensues. On the contrary a certain degree of improvement of vision is the rule, but this improvement is not great.

The condition is usually hereditary, and affects almost exclusively males. It consists of a selective invasion of the papillomacular bundle of nerve fibers, of which the cause is quite obscure. The genealogic tree of a Western Australian family, the various members of which are now scattered thruout Australasia, shows a record of 4 generations, with 22 males and 31 females now living. Of these 22 males, 10 are boys under 19 years of age and 12 are adults. Of the adults, only 1 has so far been spared his vision, the remaining 11 being all partially blind men; 8 of them became so about the age of puberty, and 3 in later life. The 1 who has so far escaped cannot be declared safe, but may also become a victim at any moment. Only 1 of the females has ever suffered from the disease. The unfortunate people disseminate their family disease broadcast, by the simple process of marrying into other families and reproducing their kind.

Fleischer and **Josenhans** made a study of 10 cases of Leber's disease occurring in a family, of whom 35 men and 41 women underwent ocular examination, and whose genealogy was traced back to about 1750. The family tree is given with annotations, and in 5 tables the optic atrophy is diagrammatically traced. The results of this family investigation is that (1) anamnesis shows that the disease attacked males of the family only; (2) in no case is the disease transmitted thru the male line; (3) the disease may attack members of the same family at an early or a late age; there is no preferential age; (4) no female of the family was afflicted.

Barth reports inheritance of familial atrophy of the optic nerve. This family tree seems to confirm Lossen's rule that this condition, like hemophilia, is transmitted thru normal women to some of the male descendants.

ATROPHY FROM ADJOINING LESIONS. —**Weisser** reports the case of a man, who after falling ten feet and suffering concussion of the brain (there was no evidence of fracture of the skull), after recovery of speech which was lost for twenty minutes, claimed he was blind in the left eye. Examination of the media and fundus showed all normal. A week later, beginning atrophy of the optic nerve was observed. The left optic nerve was thought to have been injured either by direct force or by hemorrhage into the sheath. **Blue** saw rapid atrophy with exophthalmos following a blow on the head.

Knapp, writing of blindness after retrobulbar hemorrhage, reports a case in which a man, 75 years old, experienced double vision, attributed to a fall on the left side of forehead five years before. Clinical examination and X-ray showed a soft, elastic tumor of the orbit, about the size of a bean. There was general arteriosclerosis. A radical operation was performed, during which even the smallest vessels were carefully tied. Lid function and vision were good at its close. But in the night, protrusion of the eye was followed by striking exophthalmus with bloody conjunctiva, cornea lightly clouded and anesthetic, pupil wide and staring; total amaurosis. Further intervention was refused by the patient. In the end, a widely clouded cornea and total blindness remained. The microscopic examination of the tumor showed lymphosarcoma. Eighteen months later, the death of the patient from pleurisy gave opportunity for an examination of the eye, showing that neither thrombus nor glaucomatous excavation was present. A high degree of *arteriosclerosis* was found, especially in the brain. Clearly, the pressure from hemorrhage due to this condition was the cause of paresis of the optic nerve, causing finally its complete atrophy.

Maier reports optic atrophy with sphenoid disease in a woman, 43 years old. Right eye almost complete obliteration of papilla; very gradual decrease of visual acuity. Left eye normal. X-ray findings; tumor close to midline, a little in front of the sella turcica and across the posterior bilateral ethmoid cells, extending over lateral portion of right sphenoidal sinus. Tumor has pierced bony cover of right posterior sphenoidal cells, and its pressure causes atrophy of the right optic nerve; operation refused.

King reports a case of total blindness of both eyes caused by drainage of *sphenoid and ethmoid cells*. The patient, Mrs. E. C., aged 50, with total blindness in the right eye, believed to be due to sphenoid and ethmoid disease, had complained of headache over the occipital region for three months, and over the frontal area for one week. There had been disturbance of vision in the right eye for the last four days, and total blindness in the right eye for twenty-four hours. Under local anesthesia, a simple exenteration of the anterior and posterior ethmoids was done, and the anterior inferior wall of the sphenoid was removed. Three days later the right eye gave consensual reaction. No light perception.

The vision gradually improved in the right eye, until at the end of about two weeks there was 20/40 vision. After the vision began to improve, a Wassermann test was four plus positive. Antisyphilitic treatment was given. The patient now complained of disturbance of vision in the left eye, and in a few days she had lost all vision in the left eye. At the end of a week there was no improvement in the vision of the left eye. The vision in the right had cleared up after the nasal operation from nil to 20/40. The writer then opened up the sinuses on the left side. Bare bone was felt on the outer wall of the sphenoid. From this operation she made an uneventful recovery, and has now 20/40 vision in both eyes.

Felling and Holyoak report a case of *dwarfism* with optic atrophy in a boy 12 years old. In the left eye, there was primary optic atrophy, with vision reduced to perception of large moving objects. In the right eye, the visual field is full, vision 6/9, with correction 6/6; right optic disc is pale. History shows that sight became worse and legs became crooked after an attack of whooping cough at the age of four years. X-ray examination showed the sella turcica small, but no definite abnormality detected. Mental state of patient quite normal.

Siegrist reports a case of optic atrophy due to a comparatively small, sharply circumscribed, encapsulated *hypophyseal adenoma,* which had hardly given rise to an enlargement of the sella turcica. In a very short time, it destroyed the vision of both eyes and produced typical bitemporal hemianopsia. Both optic nerves were found to have been compressed into mere tiny strands, in front of the optic chiasm. The anterior cerebral arteries, by their constant pulsations, had buried themselves into the substance of the optic nerves. The tumor did not exert any pressure on the nerves themselves, but the latter became atrophied on account of their position in a narrow and extremely constricted space.

PRIMARY ATROPHY.—**Santos Fernandez** reports a case of atrophy of the optic disc after *cataract extraction,* in a woman of mental instability. For a short time after extraction of the cataract, the patient was able to see perfectly, but within two months the vision was gone. Fernandez is firmly convinced that ocular alterations may exert a very depressing moral influence and produce a psychopathologic condition. Hence, in cases of cataract, it is of the greatest importance to risk an operation, in order to avoid a possible dementia resulting from the greatest affliction from which man can suffer, blindness.

McKeown presents a case of optic atrophy in the right eye following cataract extraction. The patient consulted him for extraction of a dislocated cataract in the left eye. The patient thought the cataract resulted from a nervous shock due to lightning striking near her.

Kayser reports the case of a woman, 63 years old, who was under constant observation for over 15 years, who 12 years ago developed unilateral marginal excavation, with vessels in normal position; 8 years ago developed deep excavations with complete displacement of the vessels. The nerve was atrophic and dead white in color; visual acuity 3 years ago was 6/6, to-day it is 6/12; there is normal field of vision; Bjerrum symptom absent; ocular pressure is 18-22 mm. No appreciable effect from eserin or pilocarpin treatment. Kayser assumes that this case represents primary lacunar atrophy, with large cavities anterior and posterior to the lamina, and that excavation was caused by the normal ocular pressure, without glaucoma. The patient's family shows several cases of physiologic excavations. One brother evidently had the same optic nerve disease, and iridectomy brought on in his case rapid decrease of bilateral vision. Kayser adds that operative prognosis is bad in cases of glaucoma associated with optic nerve disease, even tho the field of vision might still be preserved.

Arlt writes on the treatment of progressive optic nerve atrophy. Combined treatment was given: inunction of at least 120 g. of gray ointment, and neosalvarsan; followed toward the end by 3 weeks treatment by inunction, after which salvarsan treatment was started. No injury was ever observed due to mercury. Prognosis is bad in 80 per cent of the cases where the entire transverse section of the nerve is affected. Energetic treatment is indicated in the cases showing a distinctly limited visual defect, cases with central scotomata, and cases where the second eye becomes diseased at a later time. Following infection, the cases were treated either insufficiently or not at all. After the primary phenomena had subsided, the treatment was compensated. The poor prognosis for existing nerve atrophy indicates that any treatment given must chiefly endeavor to prevent progress of the disease.

Abadie urges spinal trephining and withdrawal of fluid near the ciliospinal center for progressive atrophy of the optic nerve. **Carpenter** writes on optic atrophy and **Bab** on atrophy and tabes.

SECONDARY OPTIC ATROPHIES.—**Fifield** reports a case of optic atrophy caused by *localized meningitis.* A 9 year old child experienced progressive loss of weight. A Wassermann test was negative, as were 2 Wassermanns done on the mother. One year later, examination revealed the fact that the right eye was blind; left eye, nasal vision, fingers at 3 ft. There was a tendency toward spasticity of all the muscles. The pupils reacted to light slowly, with moderate dilatation. Ophthalmoscopic examination showed both nerveheads to have simple atrophy. Examination showed impaired vision of both eyes, headache, nausea, dizziness, tinnitus, primary optic atrophy on both sides and resulting homonymous hemianopsia. X-ray showed separation of sutures of the skull. There was marked drowsiness and torpidity.

A diagnosis of suprasellar pituitary tumor was made. An exploration of the pituitary region by the frontal osteoplastic operation, made by Cushing, permitted escape of cerebrospinal fluid. Around the optic chiasm, which was exposed, were a number of adhesions, but otherwise the findings were negative. The patient did well after the operation and was discharged in about three weeks. She was readmitted a week later with acute chorea, which condition continued until her death at the end of three more weeks. Autopsy on the brain showed nothing on the surface and several transverse sections revealed no tumor. Cushing's opinion was that there must have been at some time a local meningitis around the chiasm.

Torres Estrada reports a case of atrophy of the optic nerve following *typhoid*. Estrada believes, that the presence of a syphilitic condition has a prejudicial influence in cases of typhoid or influenza. This man had chancres eleven years before. Four months befor observation, he had a mild attack of typhoid, from which he got up after a week, in full convalescence, and discovered that his vision was cloudy. It grew dimmer for a month, till he could no longer distinguish objects. The process was accompanied by persistent headache. There remained quantitative perception of light. The pupils were dilated, irregular and immobile. There was optic atrophy of a meningeal type. The Wassermann was 4 +.

Bedarski saw three cases of optic atrophy following *typhus*.

Siewers reports 2 cases of neoplasm of the anterior fossa, which confirmed Kennedy's claims that retrobulbar neuritis, with central scotoma and primary optic nerve atrophy on the side of the lesion, and concomitant papilledema in the opposite eye, are characteristic eye findings in tumors of the anterior cranial fossa.

In **Ellett's** case of optic atrophy, there were mental symptoms and fixed pupils, with hemorrhages and retinitis proliferans in one eye.

Sands reports a case of optic atrophy in a man of forty years, who suffered from bilateral optic atrophy of three weeks' duration, accompanied by nausea, dizziness, bilateral ptosis and diminishing vision. The Wassermann reaction was 4 + in both the blood and the spinal fluid. *Epidemic encephalitis* was regarded as a strong possibility, in view of the presenting symptoms. General malaise, diplopia, ptosis of one eyelid and nystagmus, appearing during an epidemic, must make one think of this disease. *Neurosyphilis,* however, was in author's opinion the disease in this case.

Ormond reported a case of *neurofibromatosis,* in which there was postneuritic atrophy in both eyes. **Marin Amat** reports a case of *ophthalmoplegic migrain,* with double optic atrophy with the ocular palsies. (See p.108.) **Butler** reports a case of consecutive optic atrophy, with extensive *periarteritis*. It was held that the acute arteritis was due to some septic condition, probably in connection with the appendix. There was slight optic neuritis of the second eye, and both fields were contracted. Vision in each eye was 6/6. **Ginsberg** reports a case of *metastatic carcinoma,* situated on the optic nerve, as the cause of total blindness. Heretofore, carcinoma metastases situated on the optic nerve have been described only by Dietrich and Elschnig.

Merz-Weigandt reports a case of *traumatic atrophy* of the optic nerves: A boy of 9, struck on the back of his head by a workman with his open palm, did not fall, but ran home crying, said he did not feel well and was put to bed. In the morning he woke up vomiting and complaining of headache. Soon afterward he lost consciousness. There was no sign of any injury about the head, no bleeding from ears, nose or mouth; the pulse was rapid but strong and regular, the temperature was normal. The boy became conscious in the evening, but was entirely blind. There was slight ptosis of the left eye, and the eyeball could not be moved. Both pupils were widely dilated, rigid, showed no reaction, and the fundus was normal. A diagnosis of fracture of the base of the skull followed by basal hemorrhage was made. Within three weeks, there was complete atrophy of both optic nerves. This confirmed the diagnosis. A fracture of the optic foramen with direct injury of the nerves would have caused immediate blindness. Here was evidently a secondary hemorrhage after slight fracture of the base. After about 14 hours, there was sufficient effusion of blood at the base to cause blindness from pressure on the optic nerves, and ptosis and immobility of the eyeball by pressure on the oculomotor nerves. But the motor paralysis disappeared while the blindness persisted.

Atrophy Following Hemorrhage.—**Terrien** discusses posthemorrhagic amaurosis, and notes two cases of defective sight following severe hemorrhage. The first was that of a woman of 30, who had been confined four months previously. Hemorrhage had been very profuse, necessitating repeated injections of serum. She consulted the writer on account of defective vision. Ophthalmoscopic examination showed partial optic atrophy. Vision of right eye was 1/4, and that of left 1/5. Visual fields were generally contracted and the lower part of each field was nearly lost.

The second patient was a soldier, 24 years of age, who had been severely wounded, and not brought in for four days. Gas gangrene had set in, and immediate amputation had to be performed. As he began to improve, he complained of loss of sight. When the writer saw him, about a fortnight after the injury, vision in right eye was fingers at 1.5 m., and in left, hand movements at a few cm. The pupils were moderately dilated and only reacted slightly to the brightest light, tho the convergence reflex was preserved. There was some haze of the optic discs and their margins were indistinct. The fields of vision were greatly contracted and, as in the previous case, the inferior part was almost abolished. The pupillary reactions recovered, and there was a small improvement in vision (R. V. 1/10; L. V. fingers at 25 cm).

Terrien's explanation is that the affection starts with retinal anemia, which allows any toxin present to act more powerfully as it is less diluted, and that the superior part of the retina, from the position of the head, has a poorer blood supply. He points out, that the rarity of such *amaurosis* in purely traumatic cases, as contrasted with their greater frequency in diseased conditions in which toxins would naturally be present, lend support to his theory.

Darier says, for arresting a persistent hemorrhage that is causing visual disturbance, all available means, medical and surgical, should be used, but he recommends serotherapy above all, as being the most certain. After hemorrhage has been stopped, use transfusion or abundant intravenous injections of artificial adrenalized serum. Locally, dionin should be instilled, with pilocarpin or eserin if the pupil is dilated. Massage to modify the intraocular tension, and when indicated, paracentesis of the anterior chamber, or better iridectomy, should also be employed. Subconjunctival injections are of great value, physiologic serum, pure or with the addition of nitrat or iodat of soda, being best. A case is reported of sudden complete amaurosis of both eyes after metrorrhagia, followed by immediate amelioration after subconjunctival injections of enesol.

Terson says amaurosis after hemorrhage is a rare occurrence, in spite of the frequency of profuse hemorrhages that might give rise to it. It hardly ever follows immediately on the hemorrhage, but makes its appearance from three to eight days later, and never at a greater interval than three weeks. It is of more frequent occurrence in patients over forty, in women, and in people in a state of bad general health. The usual ophthalmoscopic picture is one of ischemia of the optic nerve with contracted retinal arteries, and occasionally some edema of the optic disc and retina. The usual termination is partial or total atrophy of the optic nerve. The affection of sight is frequently accompanied by evidence of participation of other nerves and centers (deafness, oculomotor paralysis, intense headache, coma, polyneuritis). (See p. 329.)

Retinal ischemia alone might account for the few cases that follow directly on the loss of blood; but does not explain the majority of cases that develop at a later period. For those, he suggests a process analogous to that seen in *anaphylaxis*. The fact that the affection is most frequent in patients in a bad state of health lends some support to the theory of a neurotoxemia. Postmortem examination of cases has shown no signs of inflammation, nor have any embolisms or thromboses been observed. The conditions found have been those of an ascending atrophy of the optic nerve of peripheral origin, accompanied by degenerative retinal lesions. In addition to the usual general treatment for hemorrhage, Terson advocates repeated paracenteses of the eye and the use of dionin.

Syphilis.—**Fuchs** says, that cerebrospinal fluid findings are diagnostically important where blood Wassermann is negative, while spinal fluid Wassermann is positive: (1) For cases receiving antiluetic treatment. (2) For old cases of lues where blood Wassermann spontaneously turned negative, while spinal fluid Wassermann remained positive. Of this type, with a luetic infection of over 5 years' duration, Fuchs reported 3 with papillary defects. Together with L. Stross, Fuchs examined 84 cases of positive luetic spinal fluid; 13 among these showed optic nerve involvement. Among 46 cases of syphilis of no more than 2 years' duration, 9 cases showed papillitis with normal vision. To date there are 10 cases of papillitis with normal vision among 57 cases of recent luetic infection. In meningeal papillitis, the spinal fluid reaction is almost always strongly positive.

Negative spinal fluid findings were observed in: (a) 1 male case of recent malignant syphilis, where optic neuritis was a secondary symptom of severe papuloid iritis. This case was remarkable moreover because the fundus had a shining white scar in place of the papilla. (b) 1 female case of unilateral papillitis with marked visual disturbance. Finally, autopsy findings are given for 1 female case of bilateral meningeal papillitis. Under salvarsan treatment, the ocular fundus became again normal, but salvarsan induced acute yellow atrophy of the liver which caused death. Autopsy revealed normal optic nerve sheaths; normal vessels and connective tissue septa; considerable increase of glia and a moderate number of lymphocytes in the peripheral bundles of the optic nerve. "The histologic difference between the 2 types of optic neuritis, with or without disturbed conduction, appears unessential."

Terrien says, in disseminated sclerosis retrobulbar neuritis may precede the other symptoms. As other possible etiologic factors, one must not overlook hereditary syphilis (meningitis of the base of the brain), sphenoidal sinuitis, chilling and anemia. **Rasquin** is convinced that silver salvarsan is not dangerous in syphilitic affections of the optic nerve.

Tuberculosis.—**Slavik** reports tuberculosis of the optic papilla treated with *tuberculin.* The patient, a man aged 25, in good health up to the time of observation. Vision had been indistinct for one week in R., which appeared normal upon inspection, but was painful on slight pressure. The papilla was covered with distinct whitish exudate. Finger test showed central scotoma at 1 m. No reaction after an injection of 0.3, 1., and 2. mg. of old tuberculin. Fever appeared only after 5. mg. were given 2 days in succession. Then the fever was continuous. After four days, vision was 4/50, and in three weeks 5/50 with no scotoma, and in two months was 5/10, with disappearance of the white spots. The disease is usually primary, almost always unilateral, usually in young and apparently healthy persons, occurs suddenly, reduces vision and causes scotoma, distinct exudate on the papilla, venous hyperemia, turbidity of the retina with superficial hemorrhages and signs of degeneration. The course of the disease is strikingly benign.

Degenerations. — **Fuchs** says research was made for the purpose of observing amyloid bodies in the optic nerves of the aged. The optic tract, chiasm and optic nerves were completely dissected from 6 cadavers, between 70 and 80 years of age. In every case *amyloid bodies* were found in the intracranial portions of the optic tract. In one case, a single section of the intracranial portion contained 1500 corpora amylacea. Starchy bodies markedly decreased in number in the optic canal portion of the nerve; in the orbital portion only individual bodies were observed, not more than 15 mm. distant from the optic foramen. Again, these bodies may comletely disappear after the nerve has entered the optic canal.

Their distribution thru the various portions of the optic nerve is probably due to conditions of lymph circulation, progressing more rapidly in the extracranial than in the intracranial portions. In the latter, the lymph may possibly more frequently secrete insoluble albuminous, bodies, represented by the corpora amylacea. If these become very numerous they may injure the nerve fibers and impair vision. In every case atrophic foci were found in the optic nerve, represented by shrinking of the nerve bundles until they were almost obliterated, diminution in the medullary sheath, pigmentation, widening of the septa. No inflammatory infiltration.

Most foci were located at the nerve periphery; sometimes extending to the nerve center and occupying up to 1/3 of the transverse nerve section. Ascending was 3 to 5 times more frequent than descending degeneration. Foci were up to 20 mm. long. The probable starting point of the focus was most frequently located in the canalicular portion of the nerve. Disturbed circulation in the small vessels may be regarded as the most probable etiologic cause, spreading from the sheath of the pia and the septa to the optic nerve. Every case showed sclerotic changes in the ophthalmic and the central arteries of the optic nerve. The peripheral location of most foci should restrict the visual field at the corresponding spot in the periphery.

Hepburn showed a patient with *hyalin bodies* in the disc, with night blindness. He said that sometimes these bodies were seen with pigmentary degeneration of the retina, but this was not so in this case. There might be degeneration of the retina without pigment, but in all such cases there is a ring scotoma. The fundus was of the albinotic type, and he had a brother with a similar kind of fundus. The patient was also a myope and true night blindness was sometimes found in myopes.

Lauber, in a paper on the clinical and anatomic investigations of hyalin bodies in the optic nervehead, says ophthalmologic literature contains only 78 reports of this condition. The author has personal knowledge of 14 additional cases. His own investigations lead him to believe that hyalin bodies in the optic nervehead can be traced to the presence of "misplaced" pigmented epithelial cells in the nervehead. These "misplaced" cells can be demonstrated in embryonic eyes. Clinically, pigmented spots can be seen in the papilla, situated at greater or lesser distances from its margins. Of great significance is the common association of hyalin bodies with primary diseases of the optic nerve, such as inflammation and atrophy. Whether this association is coincidental or causal cannot at the present time be determined. The same holds true of the association of hyalin bodies in the optic nervehead and retinitis pigmentosa.

Tobler writes of *calcareous deposits* in the optic nerve papilla and their combination with cystoid degeneration of the macula lutea. He had the opportunity to study clinically 1 case of calcareous deposit in the papilla, and histologically 2 cases. The first was a female with progressive otospongiosis and atrophy of the optic nerves. Both papillas contained numerous round and irregularly roundish, yellowish-white, very lustrous deposits of various sizes, which gave them a semiglobular prominence. They were calcareous deposits, such as have been described by other authors, and which may be found on one or both papillas, localized most commonly on their edges and along the vessels. In the histologically examined cases, the author found the deposits disposed in large groups, forming a ring around the central vessels, or else confined to the edge of the papilla, and are composed of numerous concretions of various sizes and of a well defined, concentrically laminated structure. The single concretions, lying scattered in the tissue, are also laminated and surrounded by numerous hyalin droplets, deposited in the adventitia of the smallest vessels. Atrophic degeneration of the nerve fibers is caused from the pressure of these concretions. No changes of an inflammatory nature were found. The affection occurs at all ages.

Craig reports a case of degeneration and exudation around and on the optic disc in a child, aged 10 years. There was a large white patch, greyish white in parts, on the disc, and extending around on the neighboring retina. At one place it extended into the vitreous to a height of — 7 D. It had some resemblance to retinitis proliferans.

Craig saw optic atrophy and macular changes in brothers, aged 9 and 10 years respectively. The rest of the family were healthy; no evidence of syphilis. In both children, at the age of about eight years, vision was noticed to be very bad. There are extensive pigmentary changes in the retina, including the macular region. These vessels are very narrow.

The Visual Fields, Tracts and Centers

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This section of the Digest carries the literature from July, 1921 to July, 1922. For previous references see O. L. 1921, v. 17, p. 307.

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DIGEST OF THE LITERATURE

ANATOMY.—In an address on the "visual pathway and the *paranasal sinuses,*" Schaeffer brings into convenient form the leading facts regarding the anatomic relations of the optic tracts, chiasm and nerves, to the accessory sinuses and the nose. As regards the optic nerve, the significance of these relations has been discussed in the preceding section. Intracranial lesions may involve the visual pathway. A more detailed study of the lymphatic drainage of the accessory nasal sinuses and the tissue spaces about the optic nerve and commissure is needed, as well as the finer blood supply of the parts. The writer believes that herein lies the solution of some of the extensions of paranasal sinus disease to the visual pathway.

Why do the optic nerve and commissure escape involvement in even some aggravated types of posterior ethmoidal and sphenoidal infection? Why does the optic nerve so readily become involved in some cases of posterior sinus disease? Why is the canalicular segment of the optic nerve apparently a vulnerable point in the optic pathway? Why do some cases of acute optic neuritis and impaired vision clear up so quickly following adequate drainage and treatment of posterior ethmoidal and sphenoidal infections? Why does the optic neuritis in these cases occasionally lead to optic atrophy and blindness? Some of these queries are fairly easy of answer, others at present lead us into the realms of hypothesis and speculation. (See also p. 369.)

In his Doyne memorial lecture, Cross with the aid of numerous diagrams gives an excellent resume of our knowledge of the nerve paths and centers concerned with sight, connecting with facts previously known the observations made in the late war and in comparative anatomy. **Mayendorff** has written on the socalled optic radiations.

ANTERIOR COMMISSURE OF CHIASM.—In a case of acromegaly with epithelial tumor arising from the middle part of the pituitary body, **Traquair** found at autopsy a nerve tract connecting with two optic nerves. It was 2 to 4 mm. thick, and 2 mm. in advance of the chiasm, from which it was entirely separate, having its own complete pial covering. On microscopic examination by Dawson, it was found to consist of myelinated nerve fibers exactly resembling those of the chiasm. Passing into the optic nerve, these turned forward toward the eyeball, altho later a few bent back toward the chiasm. The posterior commissure uniting the geniculate bodies of the two sides is generally accepted. But the anterior commissure described by Hannover, 70 years ago, is still in doubt. Traquair points out that such bundle does not connect peripheral nerve trunks or distributions, but that the retina must be regarded as a portion of the central nervous system, and the optic nerves, as well as any such connection between them, as intercommunicating tracts connecting nerve centers. In discussion Fisher asked what might be the function of such an interretinal commissure, altho this was a question apart from that of its existence. The function of the posterior commissure was not known. Unfortunately in this case, both nerves had not been sectioned together, and some of the fibers were seen to turn back toward the chiasm and optic tracts.

PHYSIOLOGIC FIELDS OF VISION.—**Braunschweig** considers the normal binocular individual commands a visual field of 180° width, the homonymous hemianopic of only 90°. If prisms, base to the left, are placed before the eyes of a patient, with left sided hemianopsia, and the fixation remains the same, a portion of the paralyzed left visual field (next to the median line) is displaced to the healthy sight side and perceived. As the whole extent of the visual field of the hemianopic of 90 cannot be changed, it becomes shortened at the extreme right and in the same width. In reality, however, nothing is lost at the extreme right end, because the covering by the prisms does not reach so far. The resulting visual field is now composed of the displaced portion of the left field and the main portion of the right field. For practical use it is more favorably arranged by gaining valuable territory for a less important peripheral area. Braunschweig did not go beyond prism 8°. At 5 meters distance, by prisms 7° a portion of 40 cm. is gained, in reading from 3 to 4 cm. A number of patients found the prisms a relief. There was less demand on the ocular muscles in turning the eyes toward the defective side and less fatigue was experienced.

Roelofs states, that if the two retinal images are so unequal that they cannot be united to one single representation, they will be perceived almost alternately, the socalled struggle of the fields. In this struggle one of the retinal images can preponderate. That the image disappears from time to time points to disturbance of intensity, where the retinal image is perceived. The physiologic process of this disturbance is not in the retina, the process must be localized higher up in the central nervous system. Investiga- for the observation of stimuli and con- tion has demonstrated to Roelofs, that trasts well above the threshold value interest disturbances exist. The attention itself is very changeable and dependent on many factors. The multiplicity of the interest disturbances is far more stable, and where differences could be demonstrated they only were small. It will be interesting to investigate these interest disturbances also for the other senses and to compare them.

Kuroda has written on the functions and reciprocal influence of different parts of the visual field.

Erggelet, in experimental work, produced artificial high anisometropia by placing a contact glass of — 13 D. before one eye. The regular binocular vision in form of a very sensitive perception of depth could be proven by these experiments. **Froelich** has written on oscillating processes in the visual field.

Gradle again takes up the work of the study of the *blind spot,* and gives a review of the history of the discovery and investigations of the blind spot from the time of Mariotte to date. He urges that more attention be paid to the careful deliniation of the blind spot, as many points of clinical assistance can be deduced from such study.

To determine the variability of position and size of the blind spot, **Eichenberger's** method was: At 2 meters from Bjerrum's curtain, the head was fixed by chin-frontal supports, so that the visual line was perpendicular to the curtain, and the eyes at the level of the point of fixation. The center of the blind spot is above the horizontal plane thru the point of fixation, in the majority of eyes by from 1° 12′ to 1° 26′. Its vertical diameter lies most frequently from 5° 26′ to 5° 36′. Its horizontal width, the most frequent average is 3° 46′. The horizontal distance of the center of the blind spot from the fixation point amounts to from 14° to 18°.

The value found by **van der Hoeve** for the vertical diameter was 2° higher. Calculating the linear value from 5° 28′, the author found the height of the disc 1.596 mm.; this corresponds with the anatomically found size of the disc from 1.5 to 1.7 mm.

HEMIANOPSIAS.—**Arlt** reports a case of hemianopsia in encephalitis lethargica, which is of special interest, because of the fact that here (only 4 cases of hemianopsia in encephalitis lethargica have been published) the hemianopsia was the only symptom. Only in this case was the lesion of a fleeting nature. The clinical picture was unusually benign and mild. The patient was a girl 20 years of age. The source of her illness was probably the "head-grip" of a woman living in the same house.

Brudzwewski reports some rare forms of hemianopia. There may be 2 different forms of hemianopia; one, when the blindness of one-half of the visual field affects the temporal or the nasal half of both sides, and the other form, when the same blindness affects both right sided or left sided visual fields. In most cases the deficiency is a complete one. In very rare cases hemianopia occurs as "horizontal hemianopia," whereby either the upper or the lower field of vision is affected. Similar defects of vision are usually observed only in connection with injuries of the occiput. Asymmetric hemianopia may occur when the defect causing the blindness, altho situated at the opposite side of the hemisphere, only affects the visual field of one eye. Defects of the cover of the calcarine fissure cause a deficiency in the upper part of the visual field, and defects of the base in the lower part. Peripheral injuries of the lining of the calcarine fissure can only cause semicircular defects of the visual field. If fibers of the optic nerve are injured, but not destroyed, by trauma or compression, the patient is affected by disturbances of color sensation which take the picture of hemiachromatopsia.

To the rarely occurring forms of hemianopia also belongs deficiency in the central parts of the visual field. These deficiencies usually are very restricted, absolute, affect spontaneously both eyes, are situated on the right or left side of the face and are caused by small thrombi formed in the sphere of the cuneus, but sometimes they also occur after injuries of the occiput. The cerebral center connected with the function of the macula lutea is situated in the posterior part of the brain. Our knowledge of different forms of hemianopia having a central origin was considerably enlarged during the late war; they occurred exclusively in cases of injuries of the most posterior part of the brain. All observations prove that the exact center of vision is located within the calcarine fissure, and the corresponding cerebral center is found in the posterior part of the brain. A unilateral injury of the posterior part of the brain caused a corresponding hemianopia on the opposite side. But an injury of both centers could cause a bilateral horizontal hemianopia either of the upper or the lower part of the visual field, depending upon what part of the calcarine fissure was affected, the upper or the lower. Horizontal superior hemianopia is an extremely rare occurrence, since it can only be produced by destruction of the lower part of the calcarine fissure, and in this case the bullet would have to destroy at the same time the cerebellum and the main blood conduit.

Of these cases reported by **Bellows**, two were of homonymous hemianopsia with some contractions of the field, and one loss of peripheral fields thru gunshot wounds of the brain. He accepts the conclusions of Holmes and Lister, that the upper and lower borders of the calcarine fissure correspond to the upper and lower halves of the same side of the retina; that the macula is represented in the extreme posterior tip of the area, perhaps extending a little on the lateral surface; that the visual cortex from before backward represents the retina from the periphery inward to the macula, with a corresponding arrangement of optic radiations. The frequent escape of the macula in hemianopias is explained by its related cortex lying at the junction of distribution of the middle and posterior cerebral arteries, so that if the posterior is blocked this portion may escape. Defects of the lower field from gunshot wounds are more common than those of the upper, because wounds of the lower visual cortex are more likely to be fatal.

In this, the sixth paper of a series, begun ten years ago, on distortions of the visual fields in cases of brain tumors, **Cushing** describes the field defects produced by *temporal lobe lesions.* He points out the advance that has been made in the use of the perimetric examinations, the difference being as great as that between a child's sketch and an architect's drawing to scale. The author concludes that the temporal lobe is a common seat of cerebral tumor, 59 cases in a series of 276 verified supratentorial tumors. In the 59 temporal lobe tumors, perimetry, owing to the advanced stage of the process, was precluded in 20 cases. But of the remaining 39, homonymous field defects, indicating involvement of the temporal loop of the optic radiations, were present in 33 instances. The socalled uncinate fits, heretofore supposed to be the most important symptom for temporal lobe localization, were present in 24 cases. Visual hallucinations occurred in 13 of the cases. Auditory phenomena were conspicuous by their absence. **Throckmorton** calls attention to homonymous hemianopia as an early symptom of brain tumor, and **Siewers** to the eye signs of intracranial tumors of the anterior fossa.

The chief errors of diagnosis arise when, with a total median hemianopsia, the occipital lobe is considered to be the seat of the tumor; and secondly, in the absence of field defects, when symptoms supposedly of cerebellar origin are most prominent. It is fair to conclude that perimetry gives us information of paramount diagnostic importance, particularly in the early recognition of temporal lobe tumors, the partial field defects short of a hemianopsia being especially characteristic of involvement of the optic radiation in this region.

Fuchs has written on the vision of hemianopics and hemiamblyopics, and on the pseudofovea found in such cases. **Igersheimer** calls attention to the finding of spirochetes in the visual tract in paresis.

Two cases reported by **Lenz**, with autopsies, seem to throw light on localization of visual function. A man of 60, after a slight apoplectic attack, was unable to perceive his surroundings. When vision was restored a few days later, there was an absolute sector defect in both left upper quadrants. In the remaining halves of the left field and the greater part of the right fields, there was complete *color blindness,* which continued until the patient's death a year later. Color discrimination was preserved in a sector adjacent to the median line below.

The second case was of a man of 62, who had suffered left hemiplegia 13 years before. He had an absolute central scotoma of about ten degrees, and complete color blindness in the rest of the field except an area in the right lower quadrant of the field for the left eye. In both cases there were areas of softening and thinning of the white brain substance. These cases do not seem to support the hypothesis of Wilbrand, that sudden permanent loss of color sense with space sense remaining intact is caused by an external superficial lesion of the cortex, a subpial effusion of blood. He thinks rather that in dissociation between color sense and space sense, a lesion of optic conduction is the primary and essential factor. An obstacle to conduction would prevent impressions from reaching the most distal portion of the cortex, where the highest function, color perception, is located.

Roger and **Reboul-Lachaux** describe the case of a man of 45, who for a long time had had right *homonymous hemianopsia.* He suffered from epileptic attacks, which were preceded by a brief period of *blue vision* in the blind area of the visual field. These visual auras sometimes occurred as equivalents for the seizures.

PSYCHOLOGY OF VISION.—In the recent meeting of the Ophthalmological Society of the United Kingdom, the discussion was devoted to the subject of psychology of vision in health and disease. (Brit. Med. Jour. v. 6, p. 175.) The science of psychology is perhaps the most important of all the sciences, for all others, even philosophy, are subject to its laws. Ophthalmology is in a very special way able to be of use in this connection. Stress was laid on the importance of feeling tone, what has been described as the hedonic tone, in dealing with the psychology of vision. In every sensation, there is an attitude of the subject in the presence of an object, each sensation having its own state of feeling tone. The psychologic peculiarities in certain visual auras in epilepsy were described.

Under the title of vision without eyes, **Cantonnet** discusses phenomena associated with it. **Harford** with the assistance of diagrams has attempted to connect the results of seeing with the various mental processes, both normal and morbid. **Hoppe** has written on the visuopsychic cortical area in connection with hallucinations and defective visual association in sane persons. The impression of depth received from moving pictures, it is pointed out by **Polack,** is favored by the unnoticed breaks in the continuity of the pictures.

WORD BLINDNESS.—An investigation to discover something of the psychologic characteristics of congenital word blindness has been made by **Fildes.** Three explanatory theories have been put forward as indicating the nature and cause of this condition, viz:

(1) A theory which assumes the existence of definitely localized and circumscribed visual and auditory word centers in the brain, the destruction or isolation of which will destroy language in either its visual or auditory aspect. (2) A theory which interprets word blindness as only one symptom in a general lowering of mental ability. (3) One which attributes the condition to a more specialized lowering of power in the primary visual centers, rendering true visual perception of words and of other complex sense data difficult. The two main problems raised by these different interpretations are: Is inability to learn to read, or the loss of the power of reading, due to specific or general defect?

The subjects used for the investigation were twenty-six in number, all between the ages of 9 and 16 years. The investigation included experiments to test the powers of visual discrimination and retention, to test auditory discrimination and retention, and to test the power of making audiovisual associations. As a result of these experiments, the author summarizes three important points, viz: (1) Nonreaders are found among all degrees of intelligence. (2) There is nothing to indicate the existence of any such region as a "visual-word" center. (3) The theory that the experiments do support is that "wordblindness" is but one aspect of a more general, yet still in itself specific, defect in either the visual or auditory regions, or in both.

Alger reports three cases of word blindness, two of which were congenital and one acquired. From the clinical cases of acquired word blindness, it would seem that letters, numbers, musical notes, words, etc., occupy perhaps closely contiguous but nevertheless distinct areas in the visual memory centers, and that they may be destroyed, or more often perhaps isolated, by various lesions. In the congenital cases, however, it is much more likely that the defects are cortical and due to lack of development, rather than to destructive lesions. In regard to the treatment of these cases, individual instruction and an understanding teacher are indispensable. The use of block letters, spelling aloud, and reading aloud, will be of great assistance. The prognosis must be rather uncertain.

VISION IN HYSTERIA.—Reporting 3 cases of hysteria with visual disturbances, **Pfingst** speaks of a general recognition of the importance of suggestion as the chief cause of the symptoms noted. Prophylaxis is the most important step in its treatment. Blindness usually develops suddenly, altho it may occur with asthenopia or concentric contraction of the visual field. The distinction between hysteric amaurosis and malingering is sometimes impossible. The duration of the attack is indefinite. He mentions one case which ended immediately after the patient stumbled and fell. In the 3 cases here reported, one followed fright from a blow on the head by a burglar; the second who had suffered from hysteric aphonia showed contraction of the visual field following repeated examinations. The third patient, with a history of hysteria after unpleasant news, developed narrowing of the fields for blue, red and green, and paraplegia. All recovered under suggestive treatment.

Jackson points out, to understand blindness by inhibition should not be very difficult for those accustomed to use the microscope, or practice the shadow test with both eyes open—seeing with only one eye and ignoring the impressions made on the other. Suspicion of hysteria has too often caused rejection of evidence the patient could give regarding absence of sensation. Skepticism as to such conditions has been an obstacle to understanding.

Coleman reports a case of hysteric amblyopia in a 13 year old girl, which came on after being badly frightened while playing with other children. She was wearing in each eye +3.50 sph.⊃ +0.50 cyl. axis 135°. For several days she was unable to count fingers at several feet, and there was marked photophobia. Under suggestive treatment, the condition rapidly improved until vision returned to normal. The author makes no mention of an examination of the color fields in this case. **Munzer** has reported bilateral hysteric blindness.

ANTERIOR LESIONS.—Two cases of tumors of the intracranial part of the optic nerve are reported by **Dandy** as representative of a type of lesion which may be responsible for many cases of unexplained blindness, and because with proper treatment of the cause, the vision may be more or less completely restored. The lesion in question is an intracranial tumor involving the prechiasmal segment of the optic nerves, in the neighborhood of the optic foramina. There is a very definite relationship, pathologically, between these tumors and those of the intraorbital division of the optic nerve. This relationship now becomes of the greatest practical concern in all tumors involving the optic nerve, for not only does the eyesight, but quite frequently the life of the patient depend upon a correct diagnosis and adequate surgical treatment.

In the two cases presented, the tumors were so small and so precisely confined to the optic nerve, that the location of the growth was not betrayed by any signs of intracranial pressure or by involvement of the optic chiasm. In one case the vision returned from blindness to normal, in less than two weeks after the operation. In the other, there was considerable return of sight after a partial removal of the tumor. The author believes that any brain tumor which can cause a choked disc can be accurately diagnosed and precisely localized; and conversely, it can be told with equal accuracy when a tumor is not present.

Infections of the *nasal sinuses* can also be detected or eliminated with a high degree of accuracy without resorting to rather blind exploratory operations on the paranasal sinuses. In one of the cases presented there were two bilateral, symmetric tumors at the optic foramen. In the other case there was a single tumor on the left optic nerve at the optic foramen. In both cases there was bilateral loss of vision. From the case of the bilateral tumors, all of one tumor and part of the other were removed. The vision was greatly improved, as a result. In the second case the tumor could not be removed. A band of adhesions bound the tumor to the anterior clinoid process, and its incision liberated the nerve from the clutches of the tumor, and complete restoration of vision resulted. If either a primary intracranial tumor of the optic nerve or a secondary intracranial extension of an intraorbital tumor is present, only an intracranial operation which aims at the removal of the tumor, offers the patient any chance of the preservation of life or vision.

CHIASMAL LESIONS.—**Lillie** describes the ocular phenomena in cases of chiasmal lesions not of pituitary origin. The six cases described were from a group of 30, for which operation was performed, the remaining 24 being of pituitary origin. All of the cases complained of failing vision or complete loss of vision in one or both eyes. Definite ophthalmic lesions were found in all the patients at the time of examination, while only two showed definite neurologic changes. In four of the patients the ocular changes could not be distinguished from those characteristic of a pituitary syndrome; which shows the necessity of careful examination of the fields and fundi early in the course of the disease, in order to detect the progressive changes. One of the patients gave a history of changes in menses; she had uterine fibroids which had been treated by radium. None of the six patients had any evidence of acromegaly, and in four of the cases in which the metabolic rate was estimated, it varied from — 3 to — 27 per cent. Four patients died and two necropsies were obtained.

Wertheim-Salomonson reported the case of a man, 59 years old, with complaints of poor vision and deafness. He had fallen in 1895 and been unconscious for some time, and had suffered permanent impairment of vision and divergent strabismus, and had been able to do only light work. Vision had been failing gradually without apparent cause. A cloud was before his eyes in the middle of the visual field. No hereditary predisposition and no scars were found. A distinct binasal hemianopsia is present, which leaves for R. the fixation point free, while in L. the fixation point is in the defect. There is some nystagmus. Roentgenography shows a large sella turcica, but there do not exist typical symptoms of a hypophysis tumor. It is impossible to make out the cause of a shadow at the left of the sella. The author hesitates to diagnose tabes. All symptoms point to a double sided pressure on the chiasm.

Bakker reports a patient who suffered an affection of one-half the optic chiasm. He had suffered from a carbuncle on the neck, and vision had failed shortly after in the right eye. After death, section of the brain was permitted and a cerebral abscess was localized in the right half of the chiasm.

PITUITARY LESIONS.—**Moon** describes the symptoms due to pituitary tumors as being general and local pressure symptoms. Manifestations of disturbed pituitary function are: (1) Results attributed to increased or perverted secretion of the anterior lobe (skeletal, cutaneous, subcutaneous and visceral changes); (2) results attributed to increased secretion of the posterior lobe (glycosuria); (3) results attributed to diminished secretion of the anterior lobe (skeletal and cutaneous changes, sexual infantilism or retrogression); (4) results attributed to diminished function of the posterior lobe (increased tolerance for carbohydrates, adiposity, drowsiness, asthenia, lowered body temperature, arterial hypotension and polyuria). The local and pressure symptoms are headache, hemianopsias, ocular palsies, optic atrophy, choked disc, and lowered visual acuity that comes on gradually.

Treatment consists of thyroid and pituitary extracts, mercury and iodin, even in nonluetic cases. When a tumor is intrasellar, the subsellar decompression is the operation of choice, and when suprasellar, the intracranial operation should be selected. A case is reported where there was bitemporal hemianopsia, and vision in both eyes much reduced. A subsellar decompression was attempted, but had to be abandoned because of a severe nasal hemorrhage. A second attempt was made, followed by the same result, and the patient died a few days later from cerebral hemorrhage. A postmortem could not be obtained.

Among the eye symptoms of *hypophysis tumors,* **Hirsch** found that among 59 cases all had disturbance of direct vision, altho 45 had no evidence of acromegaly. Among disturbances of the visual field, he found 77 per cent had temporal hemianopsia, and bitemporal hemianopsia he considers almost pathognomonic. There was homonymous hemianopsia, in 7 per cent; impairment of the nasal field in one eye, 4.4 per cent; central scotoma, 11 per cent and other field defects in 7 per cent. The optic nerves showed primary optic atrophy, 89 per cent; recent optic neuritis, 4.4 per cent; choked disc, 8.9 per cent. One patient had hallucinations affecting the visual field, 3 had nystagmus, 3 palsies of the ocular muscles, and 5 disturbances of smell. In the 22 cases suffering from acromegaly, only 50 per cent showed disturbances of vision; 12 had temporal hemianopsia; 2 homonymous hemianopsia; 7 optic atrophy and one choked disc. In 4 cases in which the diagnosis of tumor of the hypophysis had been made, operation showed no such tumor. Among fourteen cases with acromegaly operated upon, twelve suffered from adenoma and one from cyst. A positive diagnosis of the other case is not given. **Sloan** describes the early eye findings in early pituitary disease.

Heuer, among 20 cases of pituitary tumor that came to operation, found solid adenoma in 80 per cent and cystic adenoma in the others. Of tumors starting elsewhere and involving the hypophysis, the pathologic character varies widely. Heuer found that the extension of pituitary tumors was usually forward between the optic nerves, as had previously been pointed out by Adson. Of the tumors producing chiasmal lesions, Heuer found that 73 per cent were pituitary; 24.3 per cent were suprasellar and 2.7 per cent were tumors of the optic nerve. In discussing the neighborhood signs of pituitary tumor, **Keegan** points out that they are largely ocular. Next in definiteness come X-ray evidence of the enlargment of the sella turcica; then symptoms of disordered function, giantism, acromegaly and other changes of nutrition. Evidences of increased intracranial pressure, headache, choked disc, etc., are less directly significant.

What **Carlotti** calls the hypophyseal syndrome includes 1. Ocular troubles; 2, general symptoms that may be grouped under three or four subsyndromes; 3, general accessory symptoms which may be absent. The ocular symptoms affect the visual acuity, field of vision, motility of the eye, reflexes, appearance of the optic papilla and the vision of the eyeball, the frequency and importance of these being somewhat in the order mentioned. His grouping of the general symptoms is under acromegaly, hypophyseal infantilism, and the adiposo-genital syndrome—obesity and arrest of sexual development. The evidence furnished by the X-ray includes increase and irregularity of the sella turcica, thickening of the cranial walls, enlargement of the paranasal sinuses and hypertrophy of certain viscera. **Miller** has reported genital adiposis dystrophy with cyst of the hypophysis.

Two cases of *hypophyseal carcinoma* are reported by **Lohmann**; the first symptom of a visual disturbance was bitemporal scotoma. The first case was that of a young physician; at the first examination, nothing pathologic was found except a *paracentral scotoma* located between papilla and macula. Choked discs, with extravasation of blood, developed on both sides, and distinct bitemporal hemianopia. Roentgen examination showed a change in the pituitary fossa. In spite of an operation beginning at the orbit, the patient died after a short time from carcinoma of the hypophysis. The second case was that of a girl whose disturbances were considered hysteric for a long time. Originally there was a bilateral enlargement of the *blind spot,* tho sight was keen and the fields of vision were normal. After about one year, there was a marked diminution in the acuteness of vision and distinct temporal hemianopia. Roentgenologically, hypophyseal tumor was confirmed and operation showed an hypophyseal carcinoma. The enlargement of the blind spot is indicative of bitemporal scotoma.

Other authors have previously observed that bitemporal hemianopia often begins with central scotoma and, in consequence, bilateral central scotoma would be considered an early symptom of chiasm swelling. This does not mean, however, that every chiasm tumor necessarily begins with central scotoma. The fibers of the papillomacular bundles are superior and posterior in the chiasm; on the other hand, the hypophyseal pedicle and the recess of the third ventricle, in short, parts which usually are affected in cases of chiasm tumor, border on the superior and posterior dorsal part of the chiasm.

Since people who have *entoptic scotoma* occasionally suffer from permanent hemianopia, it may be assumed that these two disturbances are related. Other authors believe that the coincidence of entoptic scotoma and defects of the field of vision is accidental. Lohmann takes a midcourse, citing two of his cases in which permanent hemianopia developed from arteriosclerosis.

Four cases reported by **Holmes** illustrate the difficulties of diagnosis in these cases. A woman of 35 had ceased to menstruate more than a year previously, began to have headaches, increasing until they were very intense and associated with vomiting. She had increased in weight from 147 to 231 pounds in 14 months. Vision had been affected for 6 months. It was 6/60 in the left eye and less in the right. There was slight narrowing of the peripheral visual fields and a scotoma, extending from the fixation point to the temporal side absolute, and included within the 10 degree circle in the right relative, and extending to the 30 degree circle in the left eye. Such a scotoma for red was absolute in both eyes. Under rest and thyroid feeding, vision improved to R. 6/24 and L. 6/36. But weight continued to increase and headaches grew worse. An attempt to operate by the temporal route was checked by hemorrhage, and she died a month later. Autopsy showed a tumor starting from the chiasm extending between the chiasm and tracts into the sella and into the third ventricle, epitheliomatous in character.

A man of 38 had lost the sight of his left eye beginning 20 months before. His right had lost vision for 6 months, and he was unable to read for three months. It showed moderate peripheral contraction of the field and relative scotoma extending from fixation point about 20 degrees to the nasal side and slightly to the temporal side below. Radiographs revealed an enlarged sella turcica. An attempt to remove the tumor yielded but a small portion thru the intranasal route; and the patient died a few days later of pneumococcus meningitis. The tumor 3 cm. in diameter was of pituitary origin.

A man of 58 noticed failure of vision in R. three months before, and it had been blind a month with pale atrophic disc. The left eye was unaffected. There was slight proptosis of the right, which increased moderately. The external rectus and other muscles of the face were weak on the right side. He died 9 months after the first symptoms, and autopsy revealed a malignant tumor probably arising in the pituitary gland, and infiltrating the base of the skull on the right side.

The fourth case was a woman of 40 completely blind, and so dull and drowsy that the history was unsatisfactory. Four months previously, she had become unable to work from headaches, mental symptoms and delusions. A month later the sight became affected, a month after that she was quite blind, and two months later still choked disc was discovered. The diagnosis of frontal tumor was made, but there were no signs indicating on which side. When she died a few weeks later, it was found on the orbital surface of the left frontal lobe. It was gliomatous, and the visual symptoms were due to metastasis into the chiasm and optic nerve.

In a case of tumor of the third ventricle with compression of the hypophysis and papilledema reported by **Claude and Schoeffer**, there was an entire absence of hypophyseal symptoms.

Lutz reports that an otherwise healthy tobacco worker, aged 33, showed, 2 years after a bump of his head against an iron pole, an alteration of his visual fields, beginning with crossed binasal quadrant anopsia and followed later by loss of the upper half of the visual field of one eye, and of the lower half of the other. The pupils remained narrow in spite of the impairment of sight. Atrophy of the optic nerve and the appearances of albuminuric retinitis developed, although there was no albuminuria. The white patches disappeared about 2 weeks after lumbar puncture. Four years after the injury, the Roentgen examination revealed slight thinning of the posterior wall of the sella turcica. Finally anosmia set in. The condition of the spinal fluid suggested an eminently chronic process, probably tuberculous, altho the spinal test remained negative, as well as the Wassermann. Most likely a tuberculoma of the interpeduncular space, or of the substantia perforata, developed after the injury. The changes of the visual fields are explained by indentation of the optic nerves, by the anterior cerebral and the carotid arteries.

The treatment of disease of the hypophysis **Carlotti** includes under organotherapy and surgery, mentioning antisyphilitic treatment. Radiotherapy in maximum doses is included with extirpation of the disease as a form of surgical treatment. It was used in 2 of the 4 cases he reports, antisyphilitic treatment and organotherapy being the other methods relied upon. Radiotherapy is favorably regarded by **Kuyjer**, who employed both radium and the Roentgen rays. **Hessberg** reports 4 cases in which radiotherapy seemed to produce improvement, and similar experiences were reported in the discussion.

Steiger reported a case of tumor of the hypophysis with acromegaly, headache and large sella turcica, bitemporal hemianopsia, weak pupil reactions, complete atrophy of the right optic papilla, the vessels being normal. Amaurotic. The left eye had beginning atrophy, corrected vision of 0.6, and narrowing of the field. Under X-ray treatments (14), vision increased to 0.9 and the field enlarged.

Sargent reports decompression on a patient, aged 21, suffering from pituitary tumor. Three years previously he had noticed that he could not see objects at his right, and for 12 months had been blind in the right eye. A transsphenoidal sellar decompression was done, and in a few weeks he left the hospital perfectly well.

Tyson exhibited a young man aged 28, with a recurring growth after an operation for partial removal two years before. Previous to operation vision was R. p.1, L. 20/50, with bitemporal hemiachromatopsia. Six weeks after operation vision was R. 20/30, L. 20/15, and visual fields were normal. About one and one half years later, vision began to fail in his left eye, the nasal field of this eye being encroached upon by the blind portion to the extent of 5° from the vertical meridian, with contraction for all colors in the nasal field. Dr. Cushing advised against further operative interference. He was given radium treatment, in Vienna, to the exposed sella turcica. There was thought to be some slight improvement in the fields. His present condition of vision is R. 20/20 with correction, with temporal pallor of disc and temporal hemianopsia, L. blind with atrophy of optic nerve. The case is presented as a follow-up case, being of interest on account of improvement having followed the different methods of treatment; operation, gland extracts and radiotherapy, with a relapse or recurrence after each; the ultimate condition being the least favorable of any.

Stieren reports the case of a printer, 40 years of age, with an enlargement of the pituitary body, whose vision in the right eye, which was reduced to 1/40, was restored to normal under the continued exhibition of pituitary substance. Whole pituitary gland, 8 grains every twenty-four hours, was continued without interruption a few days over a period of six weeks. The headaches were entirely relieved, and there was an improvement in his mental and physical condition. The therapy was continued, supplemented later by biweekly hypodermic injections of 15 minims of pituitrin, which was kept up for about three months, when the pituitary substance was reduced to 6 grains daily and bimonthly injections of 10 minims of pituitrin. Central vision constantly improved, with proportional enlargement of the visual fields.

Purser and **Maxwell** found in a woman, aged 58 years, bilateral hemianopsia and evidence of hypopitutarism. She complained of increased difficulty with reading continuing over 6 years; morning headaches, dizziness and slight "indigestion" during two years. Vision not improved with glasses. Ophthalmoscopic examination revealed pallor and shallow cupping of the disc. Perimetric examination revealed well marked bitemporal hemianopsia. Both fixation points had escaped, but on the right side the defect had encroached to within 5 degrees. A diagnosis was made of pituitary tumor. X-ray photograph showed marked enlargement of the sella turcica. Wassermann negative. Treatment was confined to glandular extract therapy.

Markel reported a tumor in the vicinity of the pituitary body, in a colored woman, aged 28, with negative personal and family history. The X-ray examination shows evidence of a tumor springing from the region of the sella turcica, approximately 33 mm. wide at the base, and 27 mm. at the apex, and about 46 mm. long. It could not be determined whether it was cystic or solid in character.

Benjamin calls attention to the fact that only comparatively recently has the literature shown that *acromegaly* is not a very rare disease. The more intensive experimental and clinical study of the pituitary gland has resulted in the accumulation of much information regarding its normal and pathologic physiology and the clinical manifestations of the latter. The patient he describes was a man, aged 33, who showed some striking manifestations of the disease: widening of the bed of the hypophyseal gland, and erosions of the base of that structure; flaring of the distal phalanges and the spindle shaped appearance of the middle phalanges; the prognathic jaw, tremendous physical development, the disproportionately long arms, the very hairy body and wide spade shaped hands and feet. The tongue was tremendously hypertrophied. Vision, however, was in no way disturbed and the fields were normal.

Cassidy and **Gifford** report the case of a man, aged 34, whose whole appearance was that of an acromegalic, and in whom a diagnosis had been made of a probable pituitary tumor. His vision was reduced to: Right eye, shadows; left eye, 20/200, not improved by lenses. On his refusal to have any operative procedures undertaken, he was told to take five grains of thyroid extract daily, under observation of his family doctor. When seen again, two and a half years later, his vision had improved to 20/20 in each eye. There is doubt, of course, whether this was a true pituitary tumor, or a case of spontaneous rupture of a cyst.

Key reports tumor of the hypophysis in a man, aged 20, who began to have nausea, dizziness and headaches, developing later diplopia and diminished sight in his left eye. He was given antisyphilitic treatment under which he rapidly improved, altho there developed the usual symptoms of acromegaly. Key regards this case as one which may be classified as outlined by **de Schweinitz**, as "hypophyseal disease where history and serologic tests do not demonstrate syphilis, but where antiluetic treatment is suggestive," and he thinks his case still more suggestive of syphilis because there was sixth nerve paralysis and chorioretinitis.

Butler reports a case of pituitary tumor in a boy, aged 22. He had bitemporal hemianopsia, the fields were getting smaller and vision failing. Growth had practically ceased at 16. No infantilism or Froehlich's syndrome. No headaches or vomiting. Reflexes normal. X-ray shows enlargement and loss of distinct shadow in the sella turcica. Thyroid and pituitary extract gave no apparent effect. It was suggested that the patient be treated with screened X-rays.

Ravdin reports the case of a physician, aged 43, who complained of diminished vision especially with reading at night, not improved with glasses. Examination of the fields revealed absolute bitemporal hemianopsia and slight contraction of retained field. A diagnosis of pituitary tumor or cyst was made. He refused to have a Roentgenogram made or to submit to operation. Five years later, a radiograph showed a large sella, and a bilateral decompression was done with a very slight improvement in vision. Death followed shortly after. There was no autopsy.

Diabetes insipidus is admittedly due to hypophyseal insufficiency. Partial or total increase in volume compresses the optic chiasm and raises intracranial pressure. **Marin Amat** elaborately discusses theories, supplies a bibliography and reports a case. The latter, in a man of 29, is one of compression of the chiasm by hypertrophy of the posterior lobule of the hypophysis, insufficiency of this lobule being also a feature of the case. Urinary secretion, 8 litres per twenty-four hours. The ocular findings were postneuritic atrophy of both papillas, especially the right. Treatment with injections of pituitrin caused reduction of the urine to 4 litres per twenty-four hours, with improvement in the visual condition.

Rosenheck and **Groeschel** report a case showing extensive destruction of the sella turcica without clinical symptoms. The patient, a man of 60 years, came for examination, altho he had no symptoms of any kind. A complete examination yielded a roentgenogram showing an extensive destruction of the sella turcica, probably from a cystic tumor of the hypophysis. There were neither objective nor subjective symptoms of any kind.

The diagnosis and treatment of tumors of the hypophysis, according to **Fejer**, has progressed considerably in the last fifteen years. Regarding the early diagnosis, the evidence from X-ray examination and the examination and photography of the base of the brain and the sella turcica play an important part. Regarding treatment, surgical or rhinologic intervention is now adopted to interrupt the course of the disease and to prevent total blindness. In these methods some advance has been made. The Horsley-Killian intracranial operation, the Schloffer-Eiselberg nasal operation, the Chiari-Kahler paranasal operation and the Hirsch intranasal operation are so dangerous, from the point of view of infection thru cerebral abscess or meningitis, that we welcome all procedures which do not open the skull and yet attempt to influence the degenerative effect, i. e., the atrophy of the tumors.

Beclére, at the Society of Parisian Hospital Physicians in 1908, declared that the X-ray plays an important part, not only in the early diagnosis of tumors hypophysis, but also in their treatment. After him, Gramenga-Gunsett, Darier, Fleischer, Juengling and Gavazenni reported cases in which X-ray treatment was followed by amelioration and cure. Kuepferle and von Szily have declared that they consider operation indicated only when there is rapidly increasing compression of the brain. Operation is also indicated in teratoma, glioma or sarcoma, which resist X-ray treatment. These tumors are not radiosensitive. Finally, Schaefer reported four cases in which there was great improvement. He has determined the technic of raying and the strength of ray necessary to penetrate sufficiently deep, and yet not to cause any disagreeable epiphenomena, such as the falling of hair or discomfort of the eye. Fejer, following Schaefer's methods, reports two cases of tumors of the hypophysis, which were greatly improved.

Lesions of Deeper Tracts.—**Koch** reports: Following puncture of the corpus callosum, in a case of brain tumor with choked disc, the symptoms immediately receded and remained completely absent for ten years. At the end of this time the symptoms reappeared, but without choked disc. Death occurred a year later. Autopsy revealed a gliomatous, cystic tumor about the size of a walnut, in the right lateral ventricle, probably originally in the corpus callosum, and severe internal chronic hydrocephalus. The connection between the ventricular cavity and the arachnoid cavity was found to be blocked. As regards the absence of choked disc during the last years of the illness, Koch suggests the possibility of an adhesion of the sheath of the optic nerve to the nerve during recession of the choked disc.

False diagnoses are reported, among them one of socalled pseudotumor (serous meningitis) in a case of cerebral tumor with choked disc, in which there was recession of symptoms following lumbar puncture, so that the patient was able to continue work for two months. Therefore, in all cases of choked disc in which a causal operation is not possible, a palliative operation should be performed.

Ellett reported a case of homonymous hemiopia in a woman, aged 64, who suddenly experienced difficulty in sight, speech and memory. Central vision was perfect. The fields showed a typical right homonymous hemiopia and the nasal edges of the disc were a little veiled. The condition remaining the same suggests a left optic tract lesion with involvement of the speech center.

Foix and **Bouttier** report a case which exhibited the syndrome of the suboptic region. The patient showed right hemiparesis, hemianesthesia without pain, hemichoreoathetosis of mild degree, with hemiasynergia and hemianopsia of the superior quadrant. There was no alexia, altho the lesion was on the left side, suboptic and possibly involving somewhat the region of the red nucleus.

Metzger reports a case of *basilar tumor* in a woman of 45. She had vision 20/60 in each eye; general apathy, vertigo followed by violent headaches. The fundi showed marked choked disc in both eyes. The visual field was almost entirely lost on the left side of each eye, leaving free each macular area. There was no pupillary reaction upon throwing light into either eye from the left field, so the lesion must involve the right optic tract. X-ray examination showed a marked cancellated enlargement of the body of the sphenoid bone pressing the pituitary body. There followed a gradual amelioration of all the symptoms, and vision improved to 20/25 in each eye. Subsequently, there was a gradual decline in her vitality, followed by a progressive paralysis, and the patient died a few months later from general debility. There was no autopsy.

Wallace reported a case of brain tumor, probably gliomatous, of the right auditory nerve close to the posterior border of the pons. The patient, aged 56, noticed dizziness and ataxia in 1917. She became blind and deaf with extreme dizziness before operation, which was done in 1920.

Lesions of Occipital Lobe.—A case of right superior quadrant anopsia reported by **Gourfein-Welt** and **Redaille** was subjected to careful postmortem examination. A woman of 54 complained of sudden impairment of vision and presented such changes in the visual fields; vision being retained on the vertical and horizontal meridians adjoining the blind quadrant. The patient died about six months after her vision was affected. Careful sectioning of the occipital lobe showed that its posterior extremity was normal; but an irregular focus of sclerosis was found in the inferior lip of the calcarine fissure, involving the visual zone and the lingual and part of the fusiform lobe, extending forward to the cornu. The inferior longitudinal fasiculus was largely degenerated. The white substance above the occipital cornu of the lateral ventrical and that leading to the cuneus was intact. Three other small lesions were found, one involving some fibers of the internal capsule, one in the external geniculate body and the other in the bandolet. These writers ascribe loss of the quadrant of the visual field to the lesion of the inferior lip of the calcarine fissure. They think that vision in the vertical and horizontal meridians indicates that these parts have a double innervation, the former from both occipital lobes, the latter in both the upper and lower lips of the calcarine fissure. The integrity of the posterior pole of the occipital lobe supports the present theory that this part of the cortex is connected with the macula, in opposition to the view of Henschen that the macula was represented in the anterior portion of the calcarine fissure. Altho the white substance situated below the occipital cornu was destroyed, that above the cornu was not injured. Hence it was believed that not all the visual fibers pass above, but as Marie and Chatelain claim, some pass below, the former going to the upper and the latter to the lower lip of the calcarine fissure. **Ochoterena** has written on the visual cortex. **Jacqueau** discusses the varieties of transitory blindness.

Cerebral emboli most frequently have their origin in the heart, being products of valvulitis or of thrombi formed when the circulation is slow. Less frequently are they produced by purulent involvement of the great arteries. **Woods** describes two cases of embolism occurring in the occipital lobe. In the first case there was a left sided, deep inflammatory focus in the region of the upper cervical vertebrae, a traumatic disturbance of that region, immediate paresthesia and weakness in the two left limbs, and sudden loss of vision in the fields subserved by the calcarine region of the left occipital cortex. There was recovery of function in the lower quadrant field.

In the second case, there was slight valvular heart disease, sudden dizziness, hemianopsia, visual paresthesia, tingling in the extremeties, and some disorientation. Later there was partial recovery of the visual fields. The prognosis in ***cerebral embolism*** depends upon the immediate cerebral lesion, the nature of associated lesions of other parts, and the gravity of the condition out of which the embolism sprang. The insufficiency of collateral connections of the terminal cortical arterioles, makes infarction almost inevitable when arterial stoppage occurs at any point. Yet the existence of even a slight collateral blood supply explains the partial recovery of function.

CRANIAL DEFORMITIES.—**Mehner** reports on 15 cases of tower skull (pyrgocephaly) with, and 6 without disturbance of vision. Three of the former and one of the latter group are described in detail. The most important clinical condition was in 12 bilateral neuritic atrophy of the optic nerve, in 1 unilateral neuritis (phthisis of other eye); in 2 simple atrophy. Exophthalmos existed in 13, horizontal nystagmus in 6 out of 15. Severe headache during development of the visual disturbances in 7. The intelligence was always rather good. Some statement with regard to a bone disease, i. e., rachitis at an early age, was made in 5, in one of them without visual disturbances. Generally the poor skeleton and defective physical development were striking. Four patients were over 25 years old, 1 over 20, 9 over 10, 6 over 5, and 1 over 4.

The Roentgen pictures are described in detail. They are very useful, but Mehner would not feel confident to infer from a Roentgen picture alone a certain conclusion, whether the patient had visual disturbance or not. Some conditions in his collections suggest that probability. Intense attenuation of the walls of the skull, very pronounced thickening of the juga cerebralia, protuberances at the region of the quadrilateral fontanelle, hyperostosis renders sufficiently clear affection of the bone in early childhood. Craniectomy, extirpation of the synostosed suture, would be the most rational procedure, after a Roentgen picture has revealed the prematurely ossified suture.

Bartels demonstrated, with the help of roentgenograms, the differences between genuine tower skull and the deformities of the skull produced by pressure, as these are exhibited in ancient Peruvian skulls. The latter do not cause disturbances of vision, which are due in pathologic tower skull to a chronic pachymeningitis that also causes the early closure of the sutures.

Schob has written on tower skull, and **Weigandt** discusses the mental condition in such patients.

Color Vision

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This section of the Digest carries the literature from July, 1921, to July, 1922. For previous references see O. L. 1921, v. 17, p. 320.

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DIGEST OF THE LITERATURE

EVOLUTION OF COLOR SENSE.—**Collins**, in the Bowman Lecture for 1921, dwells at some length on the alteration in the structural architecture of the visual organs affected by the change of environment, (during the evolutionary development of mammals), to allow for different requirements induced thereby, and discusses the way in which the color sense has been influenced by the adoption of arboreal life, with the different anatomic appearances met with in the percipient end organs of the retina. He states that from the results obtained by the various experiments upon animals, it seems evident that the color sense of monkeys is much the same as in man. Much of what the great pioneers of evolution of the last century wrote concerning the origin of the color sense has testified to the fact that the color sense of primates is far more acute than that of other mammals, and that this is due to their arboreal life with its natural accompaniment of a frugiverous diet. In mammals, as well as in birds, is exhibited a very close correlation between the character of their food and their external coloring, and it is only those who have adopted a frugiverous diet that have acquired brilliant hues.

In the evolution of color sense, definite changes undoubtedly took place in the structure of the retina. The color sense in man, like the form sense, is most acute at the macula, where cones only are present. Tho the final appreciation of both form and color is evidently a psychologic process, it seems to be an essential preliminary step in such appreciation for some change to take place in the end organs of the nerve fibers in the retina. That the change which gives rise to the sensation of form is essentially different from that which gives rise to the sensation of color is shown by the fact that the one may be deficient without the other being impaired. In cases of congenital amblyopia the form sense is defective, whilst the color sense is normal.

The essential factor in the perception of color must be due to some at present unknown reaction, which waves of light of varying wave lengths produce in the individual cones. As the perception of hues is more acute at the macula than elsewhere, we may infer that the cones in that situation are more capable of undergoing this unknown reaction than those situated in the peripheral parts of the retina. A comparison of the microscopic appearances of the cones at the macula with those at the periphery of the retina shows very striking differences in them, both as regards shape and size. The foveal cones, especially those in the very center, are long and slender. The extrafoveal cones decrease in length gradually as they extend towards the periphery, the change being most marked in the outer segment, which also gradually becomes wider.

Careful histologic examination of the cones in the retina of congenitally color blind persons might add considerably to our knowledge of color perception.

For the perception of color in the peripheral parts of the field, a larger object, intenser light and greater saturation of color is required than in the center. Given cones with a hue perceiving capacity, these requirements might be largely accounted for by varying degrees of concentration of the cones of different parts of the retina. The retinas of primates differ from those of lower mammals in having an area, the macula, in which only cones, closely packed together, are present; we should therefore, expect that the hue perceiving faculty of primates would be endowed with a capacity of seeing small patches of color, color less brilliantly illuminated, and less saturated, than in those mammals in which the cones are more widely scattered. To put it in another way, we should expect that the color sense of mammals with widely diffused cones would be comparable to that of the peripheral portions of the retina of primates.

The perception of small colored objects is essential for the existence of arboreal animals, which live mainly on fruits that they pick up with their fingers. It is by no means essential for the existence of carnivorous or herbivorous animals. For the former, even the capacity of perceiving color in large masses can have but little use, tho in the latter the power of seeing green in large areas, might be of some assistance in their search for food.

It is a source of great satisfaction to the admirers of Mr. Collins to learn that his intensely interesting lecture, with numerous plates and diagrams, is shortly to be published separately in this country.

Chance has written somewhat in detail on certain chapters in the fundamentals of color vision, preliminary to a proposed study of color blindness and an exposition of the various theories of color vision. He dwells upon the history of the study of color sense, in order to bring out the salient points in the progress of the study by observations made upon adults, children, aborigines, animals, birds, insects and fishes. He refers to features of the spectrum; of the parts of the eye concerned with color perception; the modifications of the sensations as affected by light and darkness; as well as to the changes in the ocular structures produced by light.

Dameno has prepared for his Spanish readers an admirable and systematic condensation of the chief features of the present state of the study of color vision. **Garten** has contributed a brief paper on the general subject of color vision.

Exner disputes with Hillebrand on the reasonability of Hering's assumption of the *specific brightness of colors.* He maintains that the sensory phenomena are at too great a variance with the physicophysiologic standpoint of color theories, to permit of any reconciliation. The Hering and Young-Helmholz theories, which represent the above, are opposed to each other; altho it is true that each proceeds from the fact that all color perception is based upon the three factors, tone, saturation and brightness. Nevertheless, while in Helmholtz's theory these three concepts are well defined and can be expressed figuratively, they are quite indeterminate in Hering's and cannot be so expressed. What in Hering's views is regarded as proof of the existence of the specific brightness of colors, is based upon the modern, impossible assumption of Hering, that the white valences of the different colors hold as well by twilight as by ordinary daylight vision. The differences are shown by experiment when, for example, equally bright yellow gray and blue gray mixtures are compared by diurnal illumination, which may be regarded as proof for the existence of a specific brightness. If, however, we determine the relation of the brightness of colors by daylight, as Exner has done, we find complete agreement between the observed brightness of the mixture and the computed sum of the brightness of the components. Exner, therefore, maintains that no objective reason exists for Hering's assumption of any specific brightness of colors.

PERCEPTION OF COLOR.—**Constentin** believes that color discrimination depends upon the formation of **standing** waves in the retinal cones as a result of reflection. The rods merely record the progression of the waves in the form of achromatic sensation, adequate reflection being absent. Electrons and ions play a considerable part in the theory. Color matching depends upon the production of similar complex standing waves. The waves act on the nerve sensibility thru the intermediation of electromagnetic resonators, of which there are three in the cones and one in the rods.

Schanz would explain the perception of color on the basis that it is the pigment epithelium, and not the rods and cones, which absorbs the light. The epithelium is stimulated by the light, and under such an influence electrons are propelled therefrom to be caught by the rods and cones. Light of different wave lengths corresponds to electrons of different velocity. With a mixture of colors, the electrons having different velocities react on each other until a medium velocity is attained, so that the effect is the same as that produced by a simple color having an equivalent velocity, hence a compound color acts like a corresponding simple one.

White is produced when two component rays possess velocities so dissimilar that equalization is no longer possible. Rays in the middle of the spectrum have no visible complementary colors, as these fall within the ultraviolet region. The greater the difference between colors, the more nearly compound colors approximate white. Purkinje's phenomenon is explained by the fact that red rays become inactive quickly owing to the reduced velocity, and, therefore, reduced energy, of the propelled electrons with diminished illumination. Under reduced illumination, the impaired vision of the center of the retina depends upon the interception of colored rays by the yellow pigment of the retina; and the variations in the field of vision for different colors may be related to the variations in the energy of the colors. Owing to the inhibition following disturbances in conduction, the less energetic red is affected first, whereas congenital anomalies are due to the hindrance to the absorption of certain rays by the purplish brown pigment of the pigmented epithelium.

Hillebrand replies to the critics of his work seeking the relation of the "Purkinje Phenomenon" to the specific brightness of colors. He is inclined to believe that his critics lack understanding of the problem. He would have the physical and the psychologic concepts of the problem kept separrated. The question concerns the brightness of the colors apart from their grayness or whiteness. According to the Hering theory, the specific brightness implies that brightness is not independent of hue. The Purkinje effect demands a change in the state of adaptation as well as in the stimulus intensity, and it is accompanied by a change in the relative saturation as well as in the relative brightness of the compared colors. If the brightnesses of the various stimuli are equalized at a low intensity, in the state of dark adaptation, when the intensity is increased, the phenomenon will become manifest. Red and yellow become relatively brighter, and green and blue darker, than neutral gray. It is necessary to work with pairs of colors with constant white valences, because the white valences of the various colors may change unequally during this method of studying the phenomenon. When these conditions were possible in all of Hillebrand's experiments in observing chromatic and achromatic stimuli, an alteration in the intensities of the two was produced by a change in the intensity or adaptation level. This would imply specific brightness rather than relative white valences of the two colors.

Kroh treats upon experiments of pure color contrast and pure color transformation, in a quite abstruse paper which is based largely on coordinate geometry. In his experiments, contrast of brightness and of transformation are excluded.

Gutmann describes an experimental method of *color contrast* localization, by means of which he shows that in anomalous trichromates, green light when alone produces no color sensation, but only when red light also falls upon the retina. In such cases he believes, the localization of the mechanisms for simultaneous chromatic contrast is not central but is probably retinal. Such a contrast, it is well known, is more intense in these subjects than in the normal.

Comparing the contrast patterns of monocular response with the binocular, it was found that the monocular was supernormal, while the binocular failed to respond. In the binocular field, the threshold for the addition of green to gray was found to be, for anomalous trichromatic, nine times as high as for the normal, while in the monocular field it was much lower. The contrast effect, therefore, is aroused in the anomalous subject only when the compound stimuli are presented in the same retina, greeness being experienced by the anomalous only as a result of retinal color contrast.

He found that the after image following stimulation by colored light disappeared more rapidly in anomalous cases, than in the normal subject, and that color fatigue sets in sooner; while the formation of after images in a deuteranope was not less easy than in the normal.

TIME OF PERCEPTION FOR COLORS.—Basing her observations on the improved methods of photometry by Ferree and Rand, **Bills** studied the time of visual perception. Her results varied according to the colors used, and depended on the intensity of the light stimulus. Comparative studies were made of the various methods commonly employed, with the intention to effect a standardization of the *relative lag* of colored and colorless sensations. In addition to these results, it was found that rate of the rise of sensation varied with waves of different lengths, and from white light; which variations, the author believes, indicate that the retina has a selective power in its response to wave lengths as well as a lag in full response. With the highest intensity of light used, the order of the rise rate, from the fastest to the slowest up to within two just noticeable differences of the maximum for green, was green, yellow, white and red. With the lowest intensity, the order was yellow, red, blue, green and white. With increase of intensity there was a decrease in the time required to produce the maximum response, this decrease being more rapid for green and blue and slower for red and yellow.

In his extensive experiments on the changes in the attributes of the sensations due to continuous chromatic stimulation, **Sheppard**, found that the fovea has a longer *time of adaptation* to color than have other parts of the retina. He used surface colors in sunlight and under lower illuminations, and pure spectral colors also at various intensities. He concludes by supporting Hering's theory that equilibrium adaptation yields uniformly a neutral mid grey. The time required to produce the grey varied from 40 to 229 seconds. In the case of the spectral stimuli, the time required to yield a grey for different wave lengths was found to correlate positively with the chromatic threshold, thus showing the saturation of the color to be its principal determinant.

ADAPTATION.—**Hecht** considers the basis of light perception as a reversible photochemic reaction, of which the dark reaction is bimolecular; and that dark adaptation follows such a reaction. Light adaptation occurs by shifting of the stationary state to a fresh equilibrium towards the "dark" side of the reaction. He reached his conclusions thru a new process, by which the errors of previous methods were avoided. He found that dark adaptation at the fovea proceeds at a very rapid rate during the first few seconds, being nearly complete in thirty, and practically at an end in ten minutes; allowing all corrections for the changes dependent upon the area of the pupils. It is assumed that the photochemic effect of light is a linear function of its intensity, and that dark adaptation at the fovea follows the course of the bimolecular reaction; that is, there are two decomposition products, which disappear, by reconstruction, into the original substances. The concentration of these products must be increased by a definite fraction to produce a visual effect.

Troland discusses thoroly Hering's conclusions that equilibrium sensations are essentially neutral mid gray. Complete disappearance of visual stimuli actually occur, as adduced by Hering. Troland regards the conclusions to be not inconsistent with other theories of visual response. **Ferree** and **Rand's** lantern has a wide variety of application for use in the clinic, as well as in the laboratory. The introduction of neutral filters, or Nicol prisms, permits reduction of the illumination to a point where absolute thresholds and rates of dark adaptation can be determined, while color filters convert it into a device for testing the color sense.

Von Kries has asserted that the so-called Purkinje *after image* vanishes in the region of the fovea, a statement denied by Hess, while **Frölich** has shown that the image remains visible under great illumination in all degrees of adaptation in the region of the fovea, but it vanishes under lesser degrees of illumination during dark adaptation. The persistence of the after images continues during increasing illumination as in dark adaptation. With colored lights the dependence of the course of the images has been shown to be related to the color of the exciting light. As regards Purkinje's after image, it was established that in strong light adaptation a spreading backwards in the region of the fovea occurred in all degrees of light intensity. With progressively increasing dark adaptation, to occasion an actual lapse of the image in the region of the fovea, the intensity of the stimulus must be continuously diminished.

Fröhlich concludes that Purkinje's after image can not be regarded as a separate rod effect in the sense of the *duplicity theory*. The increase of excitability, which takes place with the appearance of Purkinje's after images, begins like that of dark adaptation according to Piper, only at the expiration of 10-12 minutes. His experiments showed that at first an increase of excitability alone occurred as regards the complementarily colored Purkinje's after image, and only later were colorless after images excited by weaker light stimuli. Upon increasing dark adaptation the after image spread, while the complementary colored phase fell away, in the region of the fovea, at the beginning of such adaptation, and over a wider zone than in later stages of the dark adaptation. The width of the zone equalled 4.5°-7.4°. The author concludes that the difference in excitability between the fovea and its immediate surroundings is less than that of the periphery in all conditions of adaptation. The color exciting elements of both zones are but slightly concerned in the adaptation, but far less so than in experiments with white light.

Hardy has studied, in his own eye, the persistence of vision for various colors at numerous points on the retina within a circle of radius equal to 40 degrees. He was able to plot loci of equal persistence in circles parallel to the horizontal meridian. For the red, and the green stimuli, the persistence decreased in proportion to the distance from the fovea, while blue-violet showed very little variation.

Gutmann found, in studying the duration of after images in various types of color vision, that in anomalous trichromates the images last only about two thirds as long as in the normal subject, and, frequently, the after image fails to appear. The least difference was found with red stimuli and the greatest with orange-yellow; he employed yellow-green and blue also. The effect was proportional to the degree of the anomaly. The author is of the opinion, based on certain incomplete observations he has made, that dichromates and ordinary anomalous subjects have similar after images durations. These findings, together with his results in the measurement of the fatigue of the color sense in the anomalous, lead him to believe that the defect lies in the receptor mechanisms.

When an individual possessing the faculty of "visual images," observes an object without strong fixation, the object becomes visible again when he closes his eyes or when he regards a neutral background. Such capacity is more frequent in youth than among adults. **Herwig** found it present in 76, or 37%, of 205 boys of 10 to 14½ years of age. The image is central and can be influenced by the will and by the imagination. From a consideration of its properties it is found to stand between the after image and the ordinary vision concept. Such visual images, like the images of ordinary vision, are subject to the same general laws, altho they only show the numerous peculiarities of ordinary vision in a higher degree. They differ from after images in that they may be excited without strong fixation, and they do not change their size upon the approach or the recession of the background upon which they may be projected. Herwig employed in his experiments the image of Hering's color circle, the image of which may be positive or negative, and the individual may so modify the conditions as to convert the one into the other. To some of the observers certain of the colors in the individual image become weaker; and these colors would appear in ordinary vision after prolonged central fixation dimly in the peripheral field, altho less so than in the visual image; such dimming depending upon an inductive effect of the gray background upon the bright colors.

The author draws the probable conclusion from his experiments that the peripheral color blindness of ordinary vision is due to induction, in which endogenous gray excitation or the gray concept plays an important part. Red and green are more easily influenced by induction than yellow and blue; so also is a large field suppressed at a more peripheral portion than is a small one. If, as with G. E. Müller, we distinguish an outer from an inner form of color blindness, peripheral color blindness is an inner one, inasmuch as the isolated dimming or suppression of a color occurs at the same time as the color forms a negative after image. Examination of the visual images of an individual affected with red-green blindness showed only a dimming for red and green, somewhat more pronounced for green than for red. In this individual, also, a green which was not recognized as such, gave rise to its contrasting red. The author concludes from the study of this deuteranope that the dimming was inner, in the Schumann sense of the problem.

Experiments and Theories. In his studies on the mechanism of vision, **Tscherning** has devised what he calls "Photometric glasses," with which he is enabled to reduce the degree of luminosity. The glasses consist of strips of colored gelatin cemented between sheets of colorless glass, by means of which the light may be reduced to 1/10, 1/100, 1/1000, etc. When the light entering the eye is reduced, for example to 1/10000, at first nothing is seen, but after a quarter of an hour or so, vision becomes good. On looking through a tube placed in front of each eye at a sheet of paper so that the fields are independent, one eye will see the paper white, but the other sees it as violet; which color disappears when the free eye is closed. Red paper appears black. Tscherning believes with Young, that there are three primary sensations, red, green and violet, and holds that red and green fail when the light falls below a certain luminosity.

If it is conceded that the eye contains the elements responsive to the three components, perceiving red, green and violet, then the manifestations of red-green blindness may be explained by the hypothesis that the illumination has been sufficient to act on the violet constituents only, and is therefore, too feeble to activate the red-green. The spectral curve of the violet sensation extends to the limits of the red and is at its maximum in blue-green. The two fundamental colors of Young's three are located at the extremities of the spectrum; the third, accordingly, should be yellow-green, since the green of the spectrum contains violet.

Dissimilar colored images, when formed upon homologous regions of the retinas, produce discordant results which lead to either suppression of the images or to the binocular mixture of the colors. When it is possible to isolate these retinal perceptions by strongly concentrating the attention upon the individual images, two colors may be recognized simultaneously either as two surfaces, one in front of the other, or as two lines at one spot. **Henning** demonstrates these experiments by Cantonnet's method, as of looking thru the half closed hand, or more exactly by using the stereoscope. One eye sees, for example, a green circle while the other a differently colored background; the observer perceiving as thru a transparent green the color of the background. The transparent color may take on some configuration of its surface, which becomes, according to Katz's idea, a transparent colored surface.

In another series of experiments, he employed a series of stereoscopic figures, the outlines of which were drawn in various colors. Some of the observers were able to recognize red and blue separately and not as a blue-red mixture. The complementary colors also, as red and green, could be recognized as such by the individual eyes. The author regards this impression of "interpenetration" as entirely different from that of one color "shimmering" thru another, and from this, he concludes that it follows, physiologically, that the path of stimulation in each eye runs a separate course, and that the consensual exhibition of complementary colors is determined by peculiarities of the retinal process. To recognize the interpenetration of colored surfaces requires great attention and small surfaces, and the sense impression of interpenetrating vision is not occasioned by integration of an individual impression as a whole.

COLORIMETERS.—**Hartridge** discusses the various factors entering into the design of a visually satisfactory chemical colorimeter. He believes that the general optical design should correspond to practice in the case of microscopes. The best comparison field, the nature of the artificial light source, and the use of filters to increase accuracy, are considered.

Pfund has devised a colorimeter for detecting and measuring deviations of reflection colors from a pure white. The chromatic factor is accentuated by the use of successive reflections of light from the type of surface to be measured. The instrument ought to be of great service in paper, paint and textile industries. Its application, as illustrated by the author's analyses of a number of supposedly white surfaces. shows that even standard, nonselective surfaces, such as magnesium oxid and carbonat, are not perfectly white.

Jones describes a colorimeter operating on the subtraction principle, in which green, blue, red and neutral gelatin wedges are employed in superposition, permitting color matching of practically any object. Calibration curves of the wedges and details of design and application of the instrument are provided. The permanence of the dyes in the wedges has been insured, and, altho the instrument is primarily intended for field work, attachments have been designed for measuring small samples of transmission or reflection colors.

In his studies in retinal rivalry, **Kiesow** used a stereoscope and employed both chromatic and achromatic stimuli. With white before one eye and grey before the other, complete fusion was obtained, but the result was not the same as when mixed on the color wheel. When the grey was darkened rivalry was observed. In the case of colors, fusion was obtained with those adjacent to each other on the spectrum, but as the colors were more and more widely separated, greater and greater rivalry ensued. He found that rivalry developed slowly in the achromatic series but more rapidly in the chromatic He has not reached a satisfactory conclusion, so far, as to the effect of brightness upon the speed of the rivalry.

WHITE AND COLORS.—The comparison of the energy distributions of common light sources, by the color matching methods now in use, does not always yield exactly the same spectral distribution. According to **Hyde and Forsythe**, when the light from an untreated carbon filament is color-matched with a black body, the distributions were identical, but tungsten at different degrees yielded various percentages, while tantalum exhibited a constant ratio.

In this valuable contribution, **Priest** details his testing of experimental methods for determining a physical standard of "white light." He refers to his observations on visual response to stimulation by radiant energy, and suggests bases for practical colorimetry and color specification, and seeks to establish a reliable scientific basis for the practical diagnosis of color blindness.

Priest recommends, in place of the commonly employed lantern tests, a range of the length at which an engineer must recognize the signals in order to properly control his train. The subject would be placed at one end of the range and at the other an actual standard railway signal lantern. With his attention directed to the lantern, recognition of the signal and the time of the showing would be automatically recorded on a chronograph record. The record would be made by a lever in imitation of the engineer's throttle lever. The reaction and the time of the reaction would be recorded on the chronograph, thus serving as an index of the man's decision of the signal and as a record of the time it took him to make his decision. Comparisons of a number of determinations and of various intensities are thus accurately afforded.

In his lectures before the Royal Collage of Surgeons, in 1921, **Edridge-Green** repeats many of the subjects which already have been noticed in "Ophthalmic Literature," and are well known to the students of his researches in color vision—viz: "Standard of Rejection for Colorblind Seamen;" "Importance of Color Names in Tests for Colorblindness," The white equation, when one eye has been fatigued with spectral red light, for the other eye shows white as reddish, or any mixture as if red had been added to it. He states that many color blind persons will agree with the normal white equation; others will agree with it in some cases, when the comparison white light is diminished; and others, when increased in intensity, thus matching two white lights of unequal luminosity. "The change of hue caused by additions of white light to spectral colors," is one in which red becomes orange, then yellow, on adding white light to it; and other colors similarly alter in hue. He enunciates, "that the component part of white light which has the greatest luminosity effect is the line to which all colors tend on the addition of white light." He speaks of "anomalous white equation without color blindness;" "the white equation and color blindness;" "complimentary colors and color mixing;" "the subtraction of white light of different portions of the spectrum;" "luminosity and color," in which defects of light perception are quite distinct from defective color discrimination.

He says that many of the new facts which he gives are so novel and unexpected, that much further research is needed before definite explanation can be given of the underlying physiologic processes.

By the term "white equation" is meant the amount of pure spectral red, green and violet required to match a simple white. **Edridge-Green** studied the effect of *red fatigue* upon it, using a Fulton-Abney apparatus, by means of which portions of the spectrum are passed thru slits, and are recombined, by passing thru a lens, on a white surface. The experiments were performed in the dark. The light for the red fatigue allowed red rays from the end of the spectrum to pass. The results showed, that after red fatigue only about half as much green is required for the equation as with the unfatigued eye. In any experiments of this nature, it is essential not to allow the red fatigue to be too great, else a blue-green after effect is obtained, which will prevent exact observations. When the fatiguing light is in a certain definite region, no difference is seen between the match and simple white. The white equation and its match, he contends cannot be due to similar physiologic processes, otherwise both would change in the same ratio. The author insists that the results of his experiments are quite inconsistent with the three-sensations-theory.

Katona observed that when the eye is fatigued for white light, the phenomena of color contrast for color is interrupted, and when exposed to white and to colored light simultaneously, the chromatic value of colored light is greatly reduced.

AFTER IMAGES AND CONTRAST.—In connection with his experiments upon after images, **Fröhlich** examines the periodicity of the contrast appearances, especially of the light zone which, periodically, develops around the likewise periodic after image, and tests the relations existing between the periodicity of the after image and that of the light zone. With slight modifications the method is the same as he employed in the examination of periodic after images. His findings are as follows: The more powerful the intensity of the light employed, the more closely does the course of the phases of the light zone approach that of the phases of the after image; in consequence of this, the opposite influence is of shorter duration, and conversion into like influence occurs more rapidly. With great light intensity no demonstrable contrainfluence is present, but immediately like course of adjacent points of the visual field occurs. Accordingly, with increasing intensity of illumination the conversion into like induction and irradiation thru gradual conversion is connected with contrast; contra- and like induction and irradiation depend upon the effect of the scattered light. These effects in Frölich's opinion are inexplicable by any change effect of adjacent regions of the visual field by Hering's theory. In fact, at the margin of the retinal image a transfer of phase of the retinal image occurs in adjacent regions of the field, and this he regards as the foundation of contrast.

Color Fields.—**Swindle** is opposed to the commonly stated physiologic doctrine, that altho we cannot perceive colors with the extreme peripheral retina, we can detect motion much better with it than with the foveal region. He contends that in the majority of cases, any color that can be seen at the fovea can be seen at the periphery also. In numerous cases of certain forms of foveal color blindness, color vision may be excited in much the same way that normal sighted persons perceive colors at the periphery.

His conclusions were reached after a prolonged study of the peripheral and foveal color sensitivity of 190 observers, of whom 24 were able to recognize reds, blues and yellows better than black or white; nine were able to see nothing but black and white with the extreme periphery, altho colors were seen by the fovea—in effect they were color blind at the periphery. Ten were blind at the periphery for reds and greens; two were blind at all portions for reds and greens; one was typically red-green blind.

His results harmonized with those of Ferree and Rand in their report of "The absolute limits of color sensitivity and the effect of intensity of light on the apparent limits." (See v.17, p. 346.) He holds that if the stimulus is intense, any given color can be perceived with all retinal regions. In the study of the effects of movement, he observed that in the normal and with color blind, the more carefully the color is fixated, the sooner it disappears for all regions of the retina. The disappearance of the color indicates color blindness comparable to the usual color blindness of the periphery.

The effects of brightness of the preexposure and surrounding field exert a powerful influence upon the results obtained in chromatic perimetry. They have been studied by **Ferree** and **Rand** who are led to believe that inattention to these details may be responsible for the apparent unreliability of perimetric determinations in clinical practice, since some sort of preexposure and surrounding field cannot be avoided.

When the brightness of the exposure and of the test field are equalized, the chromatic response extends to the widest limits, whereas contractions become evident when deviations from these two factors are allowed. On account of the abrupt falling off in the color sensitivity in the periphery, these effects denote a very large sensitivity change. The sensitivity in the peripheral region is greatly depressed by dark preexposures and surrounding fields, but the sensitivity for bright values is greater in the central zones.

The difficulty of obtaining reproducible results in perimetric or campimetric determinations is so great as to lead many to question their diagnostic value. The conditions under which the fields of color sensitivity are made may so vary the results, that the charts may extend to almost any degree and the outline take on any shape. The actual distribution of retinal sensitivity is only one of the factors which influence the results; there are so many other factors to be observed, that in an endeavor to attain a greater degree of precision in laboratory studies, and, aiming to prepare reproducible results, **Ferree** and **Rand** have sought to systematize the factors which influence the apparent limits of color sensitivity.

Besides the wave length and purity of the stimulus, the most important factors, in their judgment, are the intensity of the stimulus and the precision of the control, the brightness of the preexposure and of the surrounding field, the intensity of the general illuminations, and the accuracy and steadiness of fixation. It is not possible to make a satisfactory condensation of their paper, as it is filled with directions for accurate manipulation and observation, together with the record of results obtained under varying conditions, so that the original paper should be consulted. The many other factors which the authors have treated upon from time to time, are specified therein, and, the bibliography appended cites the publications to which they would refer the worker. At the International Congress, held in Washington, in April, 1922, certain of the chapters were given again with elucidation of the factors connected with the peripheral fields of color vision.

Color Theories.—So many references have been made to **Oswald's** color theories in the past few years, that it is a satisfaction to know that there are now available authoritative monographs by the author in which are set forth the principles of his theories, of which only the barest outlines can be given here.

Oswald has not yet discovered a suitable term for the physical cause of colors, that is, light. To him color is a sensation; substances which produce colors are color substances, or pigments, and so far as they can be used as paints, they are tints. He distinguishes brilliant and dull colors. The dull colors are arranged according to their brightness, and constitute a single dimension series. Those colors which when contrasted with the dull colors form an interrelational group of color tones, the brilliant colors, are also regarded as a single dimensional group. Mixtures of a pure, or full, color with increasing amounts of white, form the series of clear brights; and with black the series of clear dark colors. Any gray whatever, mingled in varying proportions with a full color, produces dull colors. Every series is continuous, but in consequence of the impossibility for us to recognize differences less than a definite degree, it is advisable to make a division of the series. However, the unit, according to which the continuous series is divided, is arbitrary.

The author divides the series according to Zehner's principles into 10 to 100 parts, but, as differences, visually identical, are not given, whenever the same objective differences in the stimuli are present, and when the variation in stimuli occur in geometric progression (Fechner's law), the arrangement of the colors is made upon the basis of the geometric logarithmic series. The entire series of colors can thus be represented in a figure of three dimensions, the color body, which forms an obtuse double cone, of 120 degrees apex angle, such as is formed when an equilateral triangle is revolved around one of its sides. This color body may be considered as made up of the socalled equilateral color tone triangles, carrying at the upper angle white, at the lower, black, and at the third the full color. In the three sides of the triangle, the colors then occur as follows; from white to black, from white to full color and from black to full color. Parallel to the W R line (R=pure or full color) occur serially the colors of like white content; parallel to the S R line are the colors of like black content, parallel to the W S line are those of equal proportion of full color.

The circle of bright colors is divided into 100 parts, but as the differences between them is frequently too slight to be perceived, Oswald groups them into 24 colors of four grades each. Every color receives a definite number; beginning with 00 for yellow, followed by orange red (25) thru the purples and violet to ultramarine blue ('50), further thru blue green to sea green (75), returning back to yellow. These 24 colors thus form with the various degrees of mixture of white, black and gray an identical color tone triangle. The entire number of these triangles constitute the color body, at the upper apex of which is pure white, at the lower pure black, with the pure colors at the periphery of the double cone.

Oswald has lately divided this color body into geometric degrees of the individual colors as mentioned above, under the assumption that in this way visual differences could be perceived The black or white content present in every color is denoted by the small letters of the alphabet, a-z: a=pure white or absent black, z=minimum of white or deepest black. As practically esential, Oswald selects only each 2nd degree, so that only the terms a, c, e, g, i, l, n, p, are employed for white content and vice versa for black. Every color tone can thus be characterized by four symbols; first the color tone, e.g., 28 (bluish red), next two letters, of which the first indicates the white or black content, e.g., a c, medium gray. To determine a green color body exactly according to its order number, measurement must be made. This is done by the photometric method. For white, a surface is taken which reflects all the incident light. For black one which reflects none. This, therefore, is independent of perception. The proportion of full color is determined by measurement with a like colored light, that portion which is not full color, is gotten by photometric determination with the complementary color.

This edition of his "Harmony of Colors," is to a certain extent a new work, in so far as between it and the former one **Oswald** has developed a conception of the normality of colors. As in the previous expositions by the author, each color is inserted by means of a definite denomination in its definite position of Oswald's color bodies, logarithmically defined according to Fechner's law, which holds equally for light and dark colors. Of importance in the present publication is Oswald's proof that the black content of the "cold" colors must be perceptionally reckoned to the full color and not as a dimming of it. Upon this basis of *color norm,* which corresponds to the norm of the continuous tone series in music, he seeks to erect a color harmony corresponding to that of sound. The foundation here is the "color tone leader," the color circle, and the color triangles. Small colored plates serve to explain the text.

German industrial art is seeking tc convert this theory of harmonic color combination into practice. Oswald announces the main law of color harmony as follows: Only those colors can appear harmonic or congruent which stand in certain definite simple relations. Uncolored harmonies, i.e., harmonious combinations from the gray series, are produced whenever between three gray colors, which are a minimum for such harmony, the perceptible intervals are equally marked. Accordingly a harmony would occur in an interval of 1, 2 or 3 double departures from the assumed interval in the gray. Of these, 72 species can be set up; whether beyond this simple law, other harmonies are possible, remains to be determined. Harmonious combination of two or more colors occurs whenever, in the colored triangle, the white and black or pure color content correspond. In this sense, important harmonic relations can take place between two of the elements alone. With three elements, harmonic combinations occur whenever one of the components is visually of the same interval.

The author next discusses the replacement of one color by two others which act harmoniously in obedience to certain laws. Of importance here is the equality of brightness of the colors so combined. Various kinds of "tones" may be combined, that is to say, groups belonging to equal intervals in the 3, 4, etc., identical series and circles. Oswald claims to have discovered two laws in this connection: first the law of substitution, which states that in place of a single color a group of other colors may occur, whenever the latter are equivalent; second, the law of community of colors, according to which two pairs may occur together when both contain a light color from which arises an intermixture of both pairs.

Oswald proposes in this booklet to expound his color theory, so far as it is of importance in practice, especially for artisans, in a fashion not quite so elementary as in his small manual. The white-black series, the lighter colors, and the darker ones are considered in each of the four parts. The principal emphasis is laid upon practical application, that is, upon the reproduction of the various colors by means of Oswald's color boxes, which contain 12 colors of specially brilliant beauty, not, however, completely perfect. By means of the various colors with their different names, the author hopes to impress upon the perception a proper conception of color. The brochure may also be of service to the ophthalmologist as an introduction to Oswald's views.

Oswald expresses the opinion that the harmony of colors, that is, combinations which satisfy the esthetic sense, obey arithmetic laws, upon which must be based for a satisfactory answer the question of color painting. Werner rejects this view, because it places the harmony of colors upon their physical properties, and he holds that the sole criterion for a color combination lies in the eye and the mental constitution of the observer, and not in the colors, objectively, as such. Therefore, because of inherent individual differences in man, any numerical conception of the laws of color harmony, such as Oswald's, is impossible.

Sonnefeld has analyzed Oswald's method of color measurement; and in so far that it includes only pigment colors, and not homogeneous spectral lights, calls attention to an objection to his color theory. In the measuring of colors, Oswald relies upon the well known law of radiation, in that illuminated bodies absorb a portion of the incident light and reflect the remainder. Such a property depends upon the constitution of the body and the quality of the incident light. Color measurement is possible only when the color and the intensity of the reflected light can be measured. The units of measure and the various factors employed are set forth in Sonnefeld's paper, to which the interested reader is referred. Oswald considers a pure color to contain all spectral colors lying between two complementary colors and calls it half-tone.

The measurement of color in respect to tone is made according to the principle of complementary colors. The color to be measured is officially mixed with different complementary colors to produce neutral gray. The color to be measured must be illuminated by light of the complementary color; if no complementary colored light is reflected, it contains no white, if it does, it must contain white. Comparison with a gray which appears equally bright under the same illumination determines the white constituent. The black component is determined by illuminating the color to be measured with light of its own tone and the gray sought which appears equally bright under the same light. The black constituent of such equally bright gray equals the black constituent of the color under examination. In Sonnefeld's opinion, Oswald's color theory stands or falls with his "half-color postulate," which, however, in Sonnefeld's judgment, remains to be ascertained.

Best dwells upon the service which Oswald has manifested in his attempt to establish a certain nomenclature for each color, and he urges the employment of the nomenclature for the determination of the definite colors. He regards such a denomination of definite symbols and numerals as of great value in clinical medicine. He believes Oswald's theory to be defective in as much as the theory is based largely on Fechner's law which, as is well known, is subject to many exceptions. He rejoices, however, that at last a physicist has concerned himself with the theories of color vision, from the physiologic point of view and he expresses the hope that from now on physicists will pay greater attention to Hering's views.

Fröhlich gives a new theory of light and color sense, which is based upon extended examination of the processes in the light sensitive elements of the retina, and upon his personal experimental review of the physiology of the nervous system. He reached his conclusions from observations upon the *action currents* in the retinae of cephalopods. The light sensitive elements in this organism are represented by rod like structures containing visual purple, which responds to continuous light stimuli, not with a continuous excitation, but rather with waves of oscillation. With the duration of the stimulus, the electromotor power of the action current decreases; while the amplitude and, in a lesser degree, the frequency of the waves of excitation also become smaller. This constitutes a local adaptation, so that with continuous light stimulus, weaker and less frequent waves of excitation are transmitted to the centers than at commencement of illumination. Of a single action current, moreover, only the oscillating portions of the excitation processes are transmitted by the optic nerve, the nonoscillatory portions remaining limited to the retina. The same kind of adaptation must be assumed for vertebrates.

The complicated course of the dark adaptation curve in man is explained by the different courses of dark adaptation in the retina and in the visual center. The frequency of the rhythm of the retinal action current is plainly dependent upon the wave length of the exciting light. It follows, therefore, that the effect of light upon the eye depends upon three factors: (1) The energy, i. e., the intensity of a light of certain wave length. (2) Upon its absorption; and (3) upon the frequency of stimulus which every wave length, as regards the eye, possesses. The sense of brightness is connected with the amplitude of the waves of excitation of the retinal rhythm. The retinal excitations of varying frequency and power are conducted to the specifically reacting visual center, which shows all the characteristic properties of a nerve center and reacts to the excitations coming from the retina with a varying power of increase or inhibition of its tone. This excitation, in connection with the variable waves of excitation coming from the retina, is to be regarded as the physiologic condition of complementary color sensations, with black and green on one side, yellow and red on the opposite. After images, in man, are brought into analogy with the periodic reflexes in animals. Black is explained by a decrease of the tone of the center, which corresponds to a decrease of light itself. Contrast is explained as an effect of the false light and is not assumed to depend upon change effect in points of the visual field; it, indeed, occurs so that the periodic processes in contrasting fields are so interwoven that opposite phases arise simultaneously. Similar after images occur when two similar phases of periodic excitation partially cover each other.

Koellner briefly discusses the theories of color vision. The early hypotheses were based upon an analysis of the spectrum. Later on, thru a widening of physiologic and anatomic investigation, combined with, and extending, physical research, there developed theories concerning the transmutation of light waves by the nervous elements in the rods and cones of the retina, into color perception. Nothing definite is known concerning the nature of the retinal process. The more recent ideas tend to analyze all the possibilities of the difficult physicosensory problems. Chemical processes do not serve to explain color perception, neither do the physical, and the fundamental underlying psychophysical processes of the brain have failed to satisfactorily explain it. We assume a relationship between stimulation and perception by means of which individual color perceptions, such as yellow and red, become attached to certain specific stimulation processes in the retina, which are then transferred to the brain, and give rise to the certain specific sensations.

In his attempt to philosophize over the theories which have been advanced to explain the sense of color vision, **Palacios** declares that vision, as well as the other senses, cannot be explained solely by mechanical, chemical or physical theories. Two conditions are essential for any sensation—an exciting agent and a receptive structure to be affected by the agent. Vibrations of a known wave length constitute an excitant, and, in the case of vision, the retina corresponds to the receptive apparatus. He asks, "Given light and the retina, is vision determined by chemical change in the retina, or are the form and structure of the rods and cones affected?" He declares that the partisans of the physical theory have not distinguished color sensation from luminous sensation; they assert, however, that retinal cells exposed to light become shorter and wider, their granules assuming an anteroposterior arangement. Light, therefore, produces structural change, the rods become compressed and transmit pressure to the pigment cells, concentrating the pigment at the apices of the rods. The cones, however, do not project so far towards the pigment, so that their granules are not displaced. The cones reinforce the intensity of the light vibrations selectively according to the color and thus induce color sensation. Light, accordingly, acts as touch might act at a distance. Such theories, nevertheless, while illogical, are fascinating, for they do not take into consideration the subject himself. The universe is composed of energy, but energy is transmuted into vision or hearing only when perceived in the subject; without retina or ears there can be no vision or hearing.

French offers, as his contribution to the increasing confusion attending the study of color vision, an hypothesis based upon mechanophysical properties, which he declares are inherent in the cones. Each cone, it is stated, has six separate conducting elements attached to it thru neurofibrillar action. The walls of each cone are divided into three segments separately connected with the central nervous system, by which the position of a stimulus point within a single cone can be perceived. Form being perceived thru the middle segment, the discrimination of color is carried on by the external segment. This color discriminating segment is divided lengthwise into three portions which are respectively sensitive to red, green and blue light. Each of these portions is connected with the brain by a separate nerve. The difference between the rods and the cones is mainly quantitative, a stronger absorption of light taking place in the rods than in the cones. Simultaneous contrasts involve interconnections of the ganglion cells with the retina. In applying his "series" theory of vision to the explanation of color blindness, French believes that the chromatic mechanism goes out of operation in a specified order; and, on similar grounds, the Purkinje phenomenon is explained.

Smith regards French's theory as untenable. Such a mechanism, he maintains, demands a fineness of nervous apparatus, as well as a greater power of discriminating intensity, than is possible in the confines of a single cone. It is true that ocular movements affording excitation of cones scattered thruout the retina favor successive stimulation of different selections of cones, and yet such movements can bring about a confusion of the excitation in closely adjacent areas.

The idea of the action of standing waves in the receptors, as proposed by Rählmann, has been developed by **Dungern**, who adds another theory to the increasing list. Dungern assumes that the cones contain resonators which are sensitive to different wave lengths, the pairs, red-green, yellow-blue, and green-violet existing together in three separate strata. Excitations occurring in the same strata fuse, and there is some overlapping of responses, which explains the whiteness of all colors at high intensities. The red resonator responds somewhat to the waves which excite the violet.

Color vision, according to **Joly's** recent contribution to the theories of this still unsolved question, is entirely a cerebral phenomenon, the retinal elements being only the receptive organs. The theory is, briefly, somewhat as follows: When a ray of light reaches the retina, it sets free photoelectrons, each of which contains a known quantum of energy determined by the frequency, or wave length, of the kind of light to which its liberation is due. The quanta increase continuously from the long waved red end to the short waves of the violet end of the spectrum. The electrons release from the rods and cones a store of energy sufficient to send a stimulus to the brain.

The sensation of light is stimulated by the action of the photoelectrons set free in the retina. The energy of the photoelectrons is proportionate to the frequency of the light stimulus; therefore, the strength of the stimulus produced is the origin of the color sensations. Differences of wave length, or frequency, alone distinguishes the different parts of the spectrum. Natural objects absorb some waves and reflect others, hence they appear in different colors. The number of colors perceived is limited; most persons can perceive only sixteen to twenty bands in the spectrum. To the color blind, the number of bands is less, depending upon the variety of the individual defect. Under ordinary conditions the colors seem to pass gradually from one to another, depending upon the increase or diminution in the frequency of the waves of light on which the sensation of color depends. By means of an appropriate shutter any portion of the spectrum can be isolated and the whole band thus defined appears uniformly of a single color. The evolutionary development of the three primary color sensations, red, green and blue, is in accordance with the colors most frequently experienced.

It is well known that the rods and cones are the receptor cells which receive the stimulation of light, which stimulus is in turn passed on to the brain. Joly suggests that each rod serves as a starting point of an extremely delicate thread which must be the channel of communication to the brain, while the cones have shorter threads, made up of numerous fibrils. By his hypothesis, no matter what quantum of energy enters the rod, only one kind of message can be sent over its thread.

The cones are the essential structures; they communicate with the brain by fibers much stouter than the rod fibers. The cone fibers themselves are made up of many fibrils, whereas the rod fiber is single. The number of cone fibers activated depends upon the kinetic energy of the photoelectrons. The rod fiber being single can transmit only a one-fiber stimulus; it, therefore, is achromatic. The unit of light stimulus discharged by a single fibril is termed a *photon.*

Joly postulates the presence of nine fibers in the cones; the excitation of two fibers causes red; of three, green; and of four blue. Color blindness, therefore, is due to a diminution of the normal number of nine.

The rods are the apparatus by which messages of the absence or presence of light are received and transmitted without distinction as to color. But electrons entering the cones can affect two, three or four fibers according to the quantum of energy and so send different kinds of stimuli corresponding to the different kinds of light. He attempts to show that quantums of energy would be excited in these proportions by the parts of the spectrum representing the three primary colors, red, green and blue violet of the Young-Helmholtz theory.

The basis of color vision may then be stated as follows: The number of spectral quanta converted into electronic energy is controlled by the light absorption and the bleaching of the visual purple. The quanta increasing in energy from the long to the short wave lengths stimulate two, three or four cone fibrils, according to their energy. The unit of luminous stimulus, the nerve discharge of one fibril, is not accompanied by color. White is a sensation due to the activation of all nine fibrils. A highly dilute visual purple suffices, as corroborated by the fact that dark adaptation of the fovea is quite feeble. According to Joly, therefore, the manner in which the sense of vision interprets the colors of external objects depends upon the physical structure of the eye.

Peddie looks upon trichromacy in the normal eye as no longer a mere theoretic proposition, but as an accepted fact. As Helmholtz declared, Hering's theory, is actually a three color hypothesis. While most theories can account for the observed facts, the Young-Helmholtz is the simplest that can be formulated. The reason it has not been recognized is due either to the failure to observe that there is a normal trichromacy; or, to the erroneous view of the nature of the physical and the physiologic actions connected in vision, if not to the supposition that it can account for only one type of color blindness with merely individual variations. He maintains that the Young-Helmholtz theory can account for all known or possible forms of color blindness.

In an extensive review of the subject of color vision, **Troland** discusses the difficulties hindering the understanding of the various theories, and considers the general requirements of a scientifically adequate theory. He calls attention to the inadequacy of any socalled theory which does not take into consideration the conductional and central factors as well as the elements of the retina, and suggests propositions concerning the representation of luminosity in the optic nerve impulse. The aim of his paper is to discuss the problems of color vision from the point of view of neurology. He speaks of the stupendous power of the visual apparatus which can receive radiations from the most minutely infinitesimal quantity to those hundreds of millions greater. The retina is capable of dealing with almost any possible quantity of radiation, of the proper wave length. As to the solving of the riddle he hints that the task is so tremendous that no intellect has yet appeared capable of formulating a theory capable of comprehending the action of light in the characteristics of what is accepted as color.

Engelking advocates that color vision should be investigated under ordinary conditions of illumination, and with objects which have equal direct color and peripheral values. To this end he employs objects having the same physiologic saturation and he exhibits them on a ground of equal brightness. He selected two pairs of colors, one red and green, the other yellow and blue. These, physiologically invariable, colors differ from the older perimetric objects, and they can be compared with a background not differing from themselves in brightness. Measurements brought out that for normal eyes the fields for yellow and blue, and for red and green are practically identical when they are seen under favorable light conditions, that is in a well lighted room where adaptation to light is good. In the typical variety of color blindness, the limits of the visual field for both colorless and blue-yellow objects when tested with these colors were retained, altho the red-green fields were lacking. Engelking hopes that this method may become useful in differentiating congenital color blindness from the acquired.

TESTS FOR COLOR BLINDNESS.—**Thier**, at the Heidelberg Congress in 1920, described forms of apparatus for the study of color anomalies. **Winfield** and **Strong** sought to ascertain the usefulness of the Hering color blind apparatus in matching spectral red and green to yellow, and tested a hundred subjects at random. They found it accurate and readable to within a degree.

Thier describes Hess' apparatus for the examination of disturbances of the color sense in railway and marine employes. In an examination with this apparatus of 430 boys and 426 girls, in the Munich public school, he discovered 4.2% of red-green blindness among the boys, besides 2.8% anomalous red-green vision, protanopia, and 3.2% of the girls. Red vision, deuteranopia, in 3.7% of the boys and 3.9% of the girls.

In 1913-14, **Schwartz** examined the color sense of 591 individuals, and in 1914-1919, 1740, employing the anomaloscope, the Nagel, the Stilling and the Cohn methods. Of these, respectively, 102, (17.2%) and 277, (15.9%) were found defective; among which 13, (2.2%) and 42, (2.4%) were protanopes; 25, (4.2%) and 31, (1.7%) deuteranopes; 18, (3%) and 52, (3% protanomalous; and 46, (7.8%) and 152, (8.8%) deuteranomalous. With Nagel's method, only 3 among 31 deuteranopes were dectected, and none with the other methods. Among the protanomalous 5, (9.8%); among the deuteranomalous 11% and 23 (15%). Among the protanomalous 6% and 1, (1.9%); among the deuteranomalous 4.3% and 2, (1.3%) defective by Stilling's method. Finally, among the protanomalous 6%, (0.5%), and among the deuteranomalous 5% (5.9%) defective, according to Cohn's. Among the 1463 noncolor blind of the second groups, the following number did not hold perfectly, 433, (29%) by Nagel's method; 840 (59%) by Stilling's; and 79, (5%) by Cohn's; for the second group the figures were 30, 70.7% and 2.4%. The large number shown by Stilling's method are accounted for by the fact that small defects were also taken into account; if these had been neglected many anomalies would have been overlooked. Because of this, Schwartz finds Stilling's test to be unsuitable for railroads, but recommends Nagel's and Cohn's. With the Nagel test, Vierling's modification is to be recommended. That the pigment tests are not entirely adequate is shown by the fact that in 277 instances of color blindness, two individuals, one red anomaly and one green passed all three tests.

Edridge-Green describes a new spectrometer for the analysis of color blindness and normal color view.

Holth describes and illustrates his "Three-color-object" bar and charts, and their application in the three object principle in the use of the jointed perimeter, which he has used since 1903. It consists of a quadrilateral rod, bearing on one side three, Engelking and Eckstein, equal red discs, 4 cm. distant from each other; on the second side three yellow; on the third three green, and on the fourth three blue discs. If the rod is held vertically, the central object is most indistinct, if horizontally the nasal object appears in natural color, the central and temporal discs indistinct or of changed color. In addition to using it to test the color perception of otherwise healthy individuals, he has found it of great service for quick and reliable proof of central color scotoma in intoxication amblyopia and retrobulbar neuritis. Where the visual acuteness is below 5/50, three white or red objects are used; in red-green blindness, three pale grey or faint bluish objects, which these patients see as blue. It was of value in certain cases of protracted uveitis.

Jennings has modified his self recording test by removing the stone colored skeins and the shades of violet which had been found confusing in practice. He believes that the objections to his test would become fewer and fewer if the examiner would take the time to explain the method to the agitated or ignorant examinee.

Priest reports elaborate studies of *leucoscope*, a much neglected instrument, which provides a ready means for approximately duplicating the various spectral distributions of energy, characterizing common illuminants. The central feature of this paper lies in its application of the instrument to pyrometry, but some of the elements of its visual theory, in particular the personal equation, are discussed, and the determinations of the "color temperature" of daylight, at various hours between sunrise and sunset, by means of the instrument, are of particular interest to the student of vision. The curve representing this temperature as a function of the time of day is roughly half of an ellipse, with its major axis parallel to the time line, rising from a minimum of approximately 2000° to a maximum of 5400°. Very complete calibration data for use of the instrument are presented. **Wildermuth** has described a photoelectric colorimeter.

HEREDITY OF COLOR BLINDNESS.—**Doederlein** outlines the laws of *heredity*, of the composition of the germ and the chromosomatic theory with the even and uneven numbers of chromosomes; the spermatogonium and the oögonium: and of the sex determining factors, which, undoubtedly, also contains a number of sex linked hereditary characteristics, perhaps also the color sense.

To test the applicability of these laws to color sense, Doederlein studied a number of genealogic trees: he found that with the exception of a few women who were carriers of the hereditary factors, the facts corroborated the laws. The supposition of their truth is based upon the fact that, in accordance with the number of color blind men (4%), and of color blind women (0.4%), approximately 1% of all women must be carriers. Recent investigations have invariably demonstrated a typical process of heredity.

It seems that red-green blindness conforms to Horner's law, with the amplification, that women are color blind only in case of homozygosis (father color blind and mother color blind, or at least a carrier of color blindness). As regards the relations existing between the various forms of color blindness, Hess has demonstrated several modifications; however, a close relationship appears to exist only between red vision and green blindness on the one hand, and green vision and red blindness on the other. Because of the simultaneous disturbances of yellow-blue vision, the position of red blindness appears to be in the middle between green blindness and total color blindness. The occurrence of various disturbances of color vision in one family may be explained by heterogeneous inheritance from both parental branches or by a modification of the defective germ of the father, due to the influence of other hereditary tendencies, not from the mother, so that the type of disturbance of color vision is changed.

Doederlein cites the genealogic tree of his own family, which includes a number of color blind individuals, two families having intermarried three times. It is of interest to learn that among the children of a father with relative red vision and a mother who was a carrier of green blindness, one son and one daughter had normal vision, one daughter followed the father and one son the mother.

In his researches into the hereditariness of color blindness, **Hess** has arranged the cases thus far examined into three classes: 1. The case in which children exhibit the characteristics of their forebears; that is, a man might be blind for green with normal vision for blue and yellow; his daughter might exhibit exactly the same color disturbance.

2. Several members of a family might show identical color defects but of various degrees of defectiveness, as for example, two brothers might be blind for green, one having vision for blue-yellow up to 39°, while the other's vision for the same color might be equal to only 26° of the normal.

3. Among the children of one who has vision for red, some might have vision for red while others show blindness for red-green. The son of a man with normal vision for red might be typically blind for green and yet have normal vision for blue-yellow, while his two sisters have vision for red to the same degree as their father but with normal vision for blue-yellow.

Hess has not yet learned of a family in which some members are blind to red and others to green, nor found the offspring of an ancestor who had vision for red, blind for red.

Clausen's paper is an exhaustive review of **Schiötz's** work on color blindness in females and the inheritance of color blindness in man. **Vogt** includes congenital color blindness in his account of the inheritance of ocular defects. He believes that dichromasia, and other sex linked hereditary defects and anomalies, which, while never present in women, are transmitted by them to their male offspring, are dependent upon some physiologic change in the factors determining the sex of their progeny. He cites as an example of the "unpaired chromosome" an account of nine new cases of red-green blindness which he found transmitted in five matings. He gives the family trees of two new cases of red-green blindness, and compares these with the previously published tree of a family showing eleven cases of hereditary optic nerve degeneration. In his studies he was impressed by the relatively large proportion of women transmitters and of the latency of the color defect for generation after generation before it reappeared.

Daltonism, in the opinion of **Polack** and **Longuet,** is in reality a form of trichromatism with lessened perception for green. It is in their experience of frequent occurrence, and should be carefully sought for. The Holmgren skeins are not sufficient; they would recommend the color box of Clerk Maxwell.

Wirth finds from the study of 34 cases that 53% of color blind individuals exhibit anomalies of facial color, especially a hectic redness of the cheeks. A combination of these data with the data of normal individuals yields a correlative coefficient of 0.66 between color blindness and abnormal facial color. Among explanations of this fact, the most plausible seems to be that both anomalies are symptoms of a general constitutional weakness.

Larsen reported, before the Vienna Congress, the histologic findings in a globe which had been removed from a monochromatic, which findings ought to prove of great theoretic interest.

Lenz reports two cases of apoplexy, occurring in men above sixty years of age, each of whom, until death a number of months later, manifested marked color blindness with gross defects in the peripheral field of vision. Postmortem examination was made in each case. In the first case, areas of softening were found in each hemisphere of the brain, almost symmetrically in the region of the fusiform gyrus. This gyrus and the lingual were partially destroyed. Microscopically, areas of destruction in the calcarine fissure were present.

In the second case, there were no marked areas of softening in the cortex, but the central white matter was quite thin, and there was softening in the calcarine region, in the hippocampi and the corpus callosum. Microscopically, numerous areas of softening were seen distributed thruout the occipital lobe; in the region of the calcarine the cortex was extensively destroyed. This is the first publication of microscopic data concerning disorders of the color sense.

The presence of such lesions as these confirms the old idea of the effects on the visual areas of softening in the corticular region. It has been held that a special center for the color sense resides in the fusiform gyrus. In one case, despite extensive destruction of the left gyrus, there was a certain discrimination of colors in the right halves of the visual fields.

The anomalies of the color sense in each case were analogous to those found in congenital color blindness, in that they extended over all parts of the spectrum. In the second case the maximum of brightness was transferred to the short waved portion, and decreased in the long waved portion, and, there was an improvement of vision in lowered illumination.

The degree of functional disorder is in accord with the severity of the lesions of the white matter, which shows that the cause of the disorder of the color sense must be looked for in a relative affection of the optic conduction pathway. The author believes that lesions of the optic pathways must be looked upon as the primary and essential factor, because, as in the first case, there was shown not only color hemianopsia, and, as in the second place, affection of space sense, but also a dissociation of color sense and space sense.

The author cannot yet explain the genesis, in his cases, of the color blindness. He is unwilling to admit that there can be specific fibers for the color sense.

PSYCHOLOGY OF COLOR.—During the brilliant discussion on "The Psychology of Vision in Health and Disease," at the 1921 meeting of the Ophthalmological Society of the United Kingdom, **Jones** drew attention to certain interesting items concerning the psychologic reaction of individuals to color. It is well known, that in every sensation there is an attitude of the subject in the presence of an object, each sensation having its own state of feeling tone—the hedonic tone. Crude colors give pain just as discordant sounds do. We naturally seek the pleasurable and the beautiful. The mode of appreciating sensation thru sight is by *light; color, form* and *lustre*—it is partly *optical* and partly *muscular*. As we look at *color* we converge, and a sensation of *sight* is rarely without the feeling of convergence and the sense of color.

Psychasthenic cases often refuse to go out at night because they cannot see, which might be physiologically true because the rods have become exhausted thru asthenia and can not see light—the cones only give color. The rods give no color information, and in twilight, when there is not enough light to stimulate the cones that give color sensation, the warm tones fade, cold blues and greys remain, and the scarlet poppies appear black; only the lights of low intensity remain, such as yellow, green and blue.

He gave some interesting details on the effects of color on mental patients. Color has always symbolically represented the emotions—jealousy, green; anger, red; dimness the religious light of cathedral. Melancholy the poets represent by violet. Violet light is said to calm the nerves of the excited. In one hospital, windows were glazed with red, to raise the spirits of the depressed; others with blue, to calm the morbidly excited ones—with more failures than successes. At another hospital the attempt was made to influence some cases by the help of colors, yellow, blue and green, the former as a stimulant and the latter as a sedative. In the blue and green rooms fewer delinquencies were reported than in the others where no color was used.

Disorders of color vision amounting to temporary *psychic blindness* resulting from war injuries in the occipital region, occurring in a group, were studied by **Gelb.** Besides loss of color memory and amnesia for color names, complete color blindness was found, and in others red-green blindness. Discrimination of gray tones was reduced. In the estimation of surface colors, the subject declared that the color appeared as tho in space, and yet possessed depth and transparency. The effects of contrast and transformation were disturbed.

Sittig found, in three cases of brain lesion with aphasia, disturbance of color sense also. In the first case, the patient could not name a color, and could not pick out a given color, neither could he pick out the color of objects spoken of, nor objects of the color named. The second patient, while unable to name colors, recalled the color of objects and, after a few initial mistakes, could pick out the correct colored yarn. The third patient could neither name colors nor pick out colors named, but could pick out the correct colors for objects named. It is difficult to assign the cause of defective color sense to an association with the speech defect; it was, probably, a case of color amnesia, and yet all three patients made mistakes when they were tested with Holmgren's skeins, which cannot be explained on the basis of a lesion of the speech center.

Polack discusses the various conditions inherent in the eye which affect color vision, and dwells on the well known facts that the human eye is not achromatic, and that errors of refraction greatly influence the quality of color perceptions. Central rays as well as marginal are focused differently, according to the refractive quality of the lens, and states of the pupil are not without their effects upon chromatic aberrations. When the myopic eye fixes small colored areas on a black background, red appears to be more saturated, yellow more orange, green more yellowish and blue more violet; to the hyperopic eye the changes are in the opposite direction. On colored backgrounds the problem is more complex.

PUPIL REACTIONS AND COLOR.—**Engelking** considers the rods as well as the cones to be pupillomotor recipient organs. Accordingly, under the assumption of "rod-vision" as the explanation of the phenomena of color blindness, he expects that in color blindness a quite definite modification of the normal light reflex will be found dependent upon the absence of the cones, which are the diurnal apparatus. The size of the pupil in health and disease is largely influenced by the adaptative condition of the retina. The size of the pupil corresponds accordingly to the adaptation; in this sense it reaches the maximum slowly as the intensity of the light diminishes, while miosis occurs rapidly as the intensity increases. In total color blindness the dark apparatus is believed to be undisturbed and, therefore, it might be expected that the size of the pupil would be the same as in the case of normal individuals, altho differing from the normal as regards the momentary reaction to light.

In testing the pupillary reactions of a totally color blind boy, aged five, during light and dark adaptation, Engelking obtained results different from what have been observed in the trichromatic. The size of the pupil corresponded to the normal, and the light reflex was missing in extreme light adaptation. With waxing dark adaptation, the sensibility rose until the reaction appeared normal. Dilatation and contraction took place and distinctly slower than normal. Repeated, modified, illumination yielded varying results, which were easily explained by the defective visual response of the totally color blind.

The movements of the iris, and the common symptoms of color blindness are believed to be dependent upon stimulation of the dark apparatus of the retina, that is to say, the retinocerebral color apparatus may be considered to be the pupillomotor receiving organ also. The part played by this apparatus in eliciting the light reflex, in the normal eye, can only be determined by its relative capability of reacting to optical stimulations, and aside from the intensity of stimulation, it is dependent upon adaptation, and, in all probability, upon the composition of the visual purple. The movement of the iris, in total color blindness, is accordingly dependent upon diminished light adaptation, probably on account of the rapid exhaustion and tardy regeneration of the visual purple. The diminution of vision in these cases, and the immobile pupil under extreme illumination are to be explained by the absence of the function of light adaptation. The rapid decline of the normal reflex during dark adaptation, after repeated stimulation, is explained on the same principle.

COLORED VISION according to **Collins**, may be associated with a variety of conditions, physical and pathologic; changes in the media; after images; the position in which the light impinges on the eye; pathologic retinal and nerve irritation; cortical disturbances, and functional derangements.

In a discussion on the subject, **Doyne** cited eleven cases manifesting various colors in their sight.

1. A man of 65, having red vision, presented sclerosis of the choroidal vessels, and, in the macula area, a zone of colloidal formation. 2. A woman, who saw red, had striae in her lenses and colloidal formation, as in No. 1. 3. A woman with ptosis, scattered lens opacities, pale discs, diplopia and a positive Wassermann, saw inside a red ring various other colors. 4. A woman, blind in her right eye, in whose left eye was a huge detachment, saw red. 5. A woman, on whom combined cataract operation had been performed, had erythropsia. 6. A woman with optic atrophy, and a positive Wassermann, had red sight which later became grey. 7. A woman, highly myopic, complained of a number of colors, mostly purple, then black and later a variety. In Doyne's experience, retinal degeneration frequently is accompanied by such a play of colors; but this case was not one of pigmentary degeneration. 8. A young man, in whose macular areas proliferative changes were present, had photophobia and purplish yellow clouds. 9. A woman, blind in her left eye, had before the right, red, green then black clouds. The eye was normal. 10. A man, tabetic, with atrophy, had red mists. 11. A man, blind in one eye had in his myopic eye a macular hemorrhage, complained of black

rings, and, when the eye was shut, green balls.

Doyne was especially interested in the cases showing the *colloid bodies.* He could not account for the colored vision; he wondered whether the colloid interfered with the nutrition of the retina, and asked, "Could the retina, stimulated by the red rays, have a lower threshold?" Others cited cases in which colored vision had been complained of, exhibiting arteriosclerosis; tabes; central tumors; migrain; disseminated sclerosis with atrophy; and, as has been the experience of the reviewer, cataracts in various stages. Fuchs' explanation of the purple vision after snow dazzling, was cited, to the effect that the snow exhausted the visual purple, and this was followed by a rapid resecretion of the visual purple.

Clément comments on the rose colored halos which can be seen about a green, phosphorescent, zinc sulphid screen viewed in the dark. The time required for the generation of the halos is less than one-fifth of a second, and their area seems to be 150 times that of the screen.

COLOR TESTS. — **Gildemeister** and **Dieter** have had frequent opportunities to examine railway employes who had been sent for final judgment of their color sense as ascertained by laboratory tests. The men had been examined by the railway officials, but as they had exhibited peculiar defects or had shown evidences of attempting to hide their infirmities, the officials were prompted to seek the opinion of experts. The skill with which some men can cover their defects and thus escape detection is remarkable, as the reviewer can well attest.

In examining trichromates, the authors placed great reliance on the spectral colors. They cite a case which showed that an intelligent person, even tho color blind, can with sufficient experience learn to make normal comparisons without making use of well known but forbidden aids. The reviewer can well believe this, and in his experience he offers such capacity in the men examined as justification in his disapproval of lanterns presenting more than one light. A man having a typical anomaly for red, with the anomaloscope, was later able to cover his defect, which the authors were able to detect by using Model II, with a movable ocular; the subject had trained himself to recognize the unlikeness. Dieter found that after an hour's practice, he could distinguish an unlikeness so small as that of not more than two lines on the scale.

The authors obtained good results in the case of *malingering* by using projections of Stilling's plates on a white wall, and also by evoking the heightened contrast of anomaly by clouding a Nagel's three light apparatus with a large disc of opaque glass. They have not found a case under such conditions, in which, at 6 M., yellow between two red lights, was not called green, and red, between two green lights. They regard this test as especially valuable because, when the subject approaches closer, he can see the error for himself.

Engelking has sought to obtain, for use on the perimeter, colors which shall be the least affected by daylight; and he has applied these colored test objects for the estimation of color blindness by a study of the field of vision. He has observed that the red green field is lacking in protanopes and in deuteranopes; the blue yellow field is wide for the deuteranomalous and deuteranopes, but narrow for protanopia and the protanomalous.

Engelking's new test objects may serve to reveal color blindness, especially tritanopia, even tho they may not be recommended as a definite diagnostic measure to replace other tests. In acquired red green blindness, which Engelking terms, "Progressive concomittant disturbance of the color sense," red and green fade into grey without modification of tone, while the other colors of the spectrum approximate blue and yellow. In this way these new objects are well adapted for the early detection of color disturbance. In acquired blue yellow blindness the limits for blue and yellow may separate and the blue become decidedly darker than the yellow, altho the peripheral identity may remain constant. But here one is not dealing with so typical a disease process as in acquired red green blindness, which may be complicated with tritanopia. Chromatopsia, or green vision, frequently noted in detachment of the retina may be readily diagnosed by means of these colors.

Finally, the author discusses the relations of color disturbance noted in hemeralopia, in which the color sense may remain unaffected. Cases of hemeralopia undoubtedly occur in which, in addition to marked disturbance of twilight vision, affection of the color sense, particularly the perception of blue, is wanting during light adaptation, nevertheless, in such cases tritanopia is not always present, indeed, parallelism between hemeralopia and disturbance of color sense cannot be shown to occur. Cases are cited illustrative of progressive concommittant color disturbance; acquired tritanopia and congenital anomalies like deuteranomaly. He rejects, as unreliable, Jess' and others' color objects.

In a report to the Board of Trade, **Edridge-Green** states, that there is no standard of rejection for color blindness, since the wool test has become obsolete, for, by the wool test, 50 per cent of the dangerously color blind might not be detected, while of those rejected 50 per cent were not dangerously color blind. Since the Nautical Advisers agreed that the distinguishing of red, green and white lights at a distance of a mile would qualify one for the purpose of navigation, the point for consideration is the degree of defective perception corresponding to a failure to distinguish between the lights at a distance of a mile. And, as 25 per cent of men have diminished color perception, ranging from complete blindness to superperception, it is necessary to draw a dividing line of safety between the defective and the remaining 75 per cent. Five per cent will fail to distinguish between the lights at sea and those of the test lanterns, and also with Edridge-Green's spectrometer and cards. He claims that his spectrometer is an exact and convincing instrument.

The spectrometer lantern test is efficient, and detects also acquired cases with scotomata, as well as those defective at the red end of the spectrum. Edridge-Green declares that the standard which he proposes is based on facts, and provides safety for distances greater than a mile, and its employment will tend to diminish rather than increase the number of candidates rejected.

In commenting upon Edridge-Green's report, the British Journal of Ophthalmology (v. 6, p. 125) states, that a simple test to afford safety on ships and in the railway service has long been sought; and, it is agreed upon by all, that the person who has the ability to distinguish lights accurately a mile distant at sea, has sufficiently good color perception for navigation. But the author is charged with basing his views upon his own peculiar theories, and that he is not justified in stating that the "standard" which he proposes is "based only on facts," for, there is an entire absence of any definite "standard." Moreover, the "standard" would not hold good in practice.

The universally accepted rule rejects the candidate who mistakes a red light for a green or vice versa, and the British Board of Trade demands that other mistakes shall be considered, such as calling white red or green; red green or white. Further examinations by spectroscopic tests prove that the mistakes may be either trivial or serious, yet the lantern cannot definitely decide. Decision should be at the hands of a nautical adviser, a physicist and an ophthalmic surgeon. Such a rule was provided by the British Board of Trade until Edridge-Green was appointed the Special Examiner, and his appointment, with the inevitable exercise of the "standard" which he proposes, is tantamount to abandoning the recommendations heretofore in force. To this criticism **Dunn** would enter a strong protest.

An engineer who had been in service twenty-eight years, and who had passed five examinations, according to the Stilling, Nagel, and Holmgren tests, was found to have, after a railroad accident, a typical congenital red green color blindness. In discussing the case **Hess** was led to believe that in congenital color blindness we have to deal with either a red or green blindness; or individual differences in the color sense; that is to say, inequality of red green perception in which there is a relative red visuality or a relative green visuality, or an undervaluation, in which colors or pairs of colors are seen as tho veiled with white or grey. In the same sense there may be an overvaluation. Railroad employes should always have their color sense tested for red-green blindness. Hess regards green inequality as not sufficient cause for rejection when of low degree, but assuredly so when of high degree. The ordinary tests commonly employed are not sufficiently accurate; Hess considers the use of continual lights, variable by means of color filters, the best method.

Gilbert treats briefly of the color sense, of its disturbance as well as the means for its investigation, and critically studies the disastrous railway collision at Dresden on Sepember 22, 1918. He believes that the collision occurred, not only because of attested color defectiveness, but also thru gross negligence. The color disturbance of the locomotive driver was congenital in origin, of the deuteranopic or deuteranomalous type, as was proved by five tests over a period of thirty years by means of the Holmgren, Stilling, and Nagel tests. The anomaloscope, however, had not been used.

Hess continues the discussion of the question of the fault of the engineer in the catastrophe, and points out that the rules of the road had been complied with, which required that the signal lights should be visible at a minimum distance of 130 meters, a circumstance upon which the judgment of the trial court was based. Also it was learned that tests had been made of the visibility of these lights, altho at the time it was not known that the engineer was color blind. It was observed that the signal lights could appear to the engineer quite like other lights, to which there were many in proximity of the track near Dresden. Hess thinks that the question reduces itself to whether normal individuals would be able to recognize white lights with certainty at a distance of 130 meters. Moreover, if it is desired to make the experiment with the ordinary red signal lights, it should be done with individuals affected with red green blindness like that of the engineer, and not with normal individuals.

Grow's extremely practical remarks are based on his experience in the examination of the color sense of various persons in the United States Naval Service. He draws attention to the effect of luminosity in making manifest color deficiency, and he recommends that testing apparatus should have appliances to graduate the luminosity of the colors. Cases of acquired color blindness are cited, in which the form sense was affected, a condition not present in the congenital type. He emphasizes the importance of repeated careful painstaking efforts in the examinations, that examiners should be trained and be able to interpret the findings recorded; and to detect the tricks and schemes of those who would deceive. He stresses the importance of quiet in the examining room and of not naming the colors. The efficiency of any one test depends in a great measure upon the skill, judgment and common sense of the examiner.

In his opinion the Stilling plates would be of far more value if all color blind individuals presented the same defect, but as they vary greatly, this test fails to detect many. The Nagel test is a delicate one, and requires, for satisfactory results, not only keen color perception but an active mentality as well. He finds these tests impracticable for use in the examination of a large number of men in a limited time. He found the Wolffberg and the Weber tests more or less unreliable. These tests are quantitive in character, whereas in the Navy it is the qualitative perception that is sought for. Has the applicant normal color vision, or not?

He should be rejected for occupations that require the recognition of colored lights at night or colored flags by day, if his color vision is below normal. In practice, he would class that man as normal who, when placed before reliable tests, gives evidence of seeing the primary colors accurately. The other extreme is that man who can see violet as a distinct color in the spectrum. The ideal test is one which would give a minimum of color vision, below which no one should pass, and above which it would be perfectly safe to accept. The author is at work on such a test which he promises to put forth in the early future.

He cites the objections to the Holmgren skeins. They do not detect cases of blindness from shortening of the red end of the spectrum, especially for mixtures at the extreme end. He regards the skeins as deficient in dark browns and dark greens. The skeins, having different degrees of luminosity, afford an intelligent observer an opportunity to conceal his defect by comparing the relative values of the skeins. He states that the medical officers of the United States Navy are given special instruction in the use of the test and only the original directions of Holmgren are followed. He believes that the Holmgren test has much that is good in it, and he offers as proof of its efficiency the history of its use in the past forty years, during which not one serious accident has occurred at sea in our Navy which could be attributed to defective color perception.

The author considers the Jennings test inferior to the Holmgren for Navy purposes, and cites an account of the testing of a group of officers and enlisted men as proof of the inefficiency of it.

As to the use of lanterns, Grow would not have too much dependence placed upon any one of them to the exclusion of others. The colored day flags have an inestimable value. Lanterns require the naming of the colors, and take up much time in their use. He has had great satisfaction with the Edridge-Green lamp, in special testings and in using it to confirm other results, yet, he declares that it presents far greater chances for error than does the Holmgren test. The complexity of this lamp requires trained examiners; it is lighted only electrically; repairs cannot readily be made except in England; it is expensive; and in the end it is doubtful if the results are as accurate as the Holmgren yarn skeins. As to Edridge-Green's bead test, the author ends by saying that "anyone who satisfactorily completes this test certainly has no color disturbance at the fovea."

Defects and Diseases of the Eyeball

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This section carries the literature from July, 1921, to July, 1922. For previous references see O. L. 1921, v. 17, p. 356.

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DIGEST OF THE LITERATURE.

Development of Eyeball.—Details of the closure of the choroidal fissure in chick, mouse, and human were described at length by **Mann**. In all of these embryos, the process is similar, and the value of the description lies in the minute details for which the reader is referred to the original. The larvae of Salamandra Maculosa is very apt to show socalled natural malformations, which were studied in 54 instances by **Fessler**. He concluded that the differentiation of the retinal layer of the optic "anlage" (rudiment) is such that the tapetum cells never arise from the retinal "anlage." Furthermore, the differentiation of the retinal "anlage" can under certain circumstances be altered and directed along abnormal lines, so that the development of the retina into layers is prevented and pigment is deposited in the cells of the retinal layer of the optic "anlage." Experimental work on the salamandra was done by **Fischel** with reference to the position and form of the primary "anlage" of the eyes, and with especial attention to the causal genesis of cyclopia. He considers that the cause of cyclopia is a chemical one, which appears before the primary form anlage can be recognized, and is before the time when the grouping of certain cells which lead to the formation of the optic vesicle has been completed. He further studied the mechanics of the development of the lens, and concluded that there is a definite pressure within the lens vesicle which forces the lens fibers to assume their definite form and position. The article is well illustrated and has a very complete bibliography.

After reviewing the normal development of the eye, **Stockard** points out that the large size of the primary eye, the numerous structures which become secondarily associated with it in development, and the long embryonic period during which these structures arise and differentiate, tend to render the eye liable to numerous arrests and defects in its development. When the embryo is subjected to low temperature or deprived of oxygen, parts then developing most rapidly will be injured. Low temperature when the optic vesicles should arise from the neural tube will suppress them. Later they will not develop, or do so in abnormal fashion. It is difficult to interfere to any marked extent with embryonic developments without injuring the eye, which furnishes a valuable index of the perfection of development of an individual. By experiment, Stockard has found that almost all accessory parts of the ophthalmic apparatus may arise and differentiate normally in complete absence of the primary optic cup and retina.

Anomalies. — **Klopstock** reports familial *cyclopia* and *arhinencephalia*. The parents were first cousins, no syphilis. The father was shot in the head in 1915, losing the sight of one eye. Five children were born, all monsters. The fourth was the case reported. Klopstock discusses the question of the effects of consanguinity on monsters. Since Hertwig has succeeded in bringing about disturbances in the development of the central nervous system in frogs, by means of radium and the Roentgen ray, it is possible, altho it is not proved, that external influences may also produce in man a cyclopia; and that the responsibility rests with the germ cells. This may be due to disease of the parents (syphilis, alcoholism) but may be constitutional and hereditary.

Bierring describes a case of congenital, bilateral *anophthalmos,* in a girl aged 4 days, normally developed in every other way. The parents and two sisters were normal in every way. The upper and lower edge of the orbit were very close together, but the edge could be felt all around the orbit. No eyeball could be found on either side by means of palpation. Only a clinical diagnosis of anophthalmos could be made, and the author believes that a microscopic postmortem examination may show that the case is really one of microphthalmos. **Santos Fernandez** also reports congenital absence of eyeball.

In a case of *microphthalmos* with coloboma of the iris, choroid, and optic nervehead, by means of special stains **Bergmeister** was able to show a hypoplasia (the sense as used by Gilbert) of the optic nerve. To make up for the deficiency of nerve fibers, there was a hyperplasia of glia and connective tissue. The increase in glia may be sufficient, even to resemble a small tumor, while in other instances the glia may have broken down and left vacuoles. So there cannot be established a sharp line of demarcation between hyperplapsia and tumor, and to cover such cases, as well as tuber sclerosis of Van der Hoeve, blastoma, etc., Bielschowsky's term of "spongioblast" is well chosen.

Usher wrote at length on the pedigree of microphthalmos, showing that the majority of the reports covered a single generation, or at most parent and child. He presented five pedigrees, showing continuous descent of the anomaly in three generations; one pedigree showing discontinuous descent, but with affected members in three generations; and one pedigree with both continuous and discontinuous inheritances with affected members in three generations. None of these cases were myopic. However, he did describe several cases of microphthalmos with *corectopia* and myopia, all descended from a proven myopic male. All of these abnormalities were present in each individual and appeared in successive generations. The microphthalmos and corectopia were invariably bilateral, and in each case, but one, the pupils were displaced upward and inward.

Van Duyse described a case of colobomatous microphthalmos, illustrated with ten microphotograms. The anomaly was bilateral and was accompanied by a bone cyst of the orbit and numerous other malformations. Another male child with various malformations was born to the parents of the previously described case. **Ash** gave the pedigree of a family in which eleven, out of the thirty-four traced members, were blind with microphthalmic eyes. All of the affected members were male and the condition was transmitted thru healthy females. Two nonrelated children were observed by **Lohman,** who found microphthalmos, changes in the terminal finger phalanges, and a peculiar skull formation as revealed by the Roentgen ray. He suggested that this triad may appear oftener than has been previously noted. An excellent, but brief resume of the history of microphthalmos preceded the article.

Wright described six cases of microphthalmos, one of whom had a cataract and the other five showed either colobomata, irregularity in size or shape of globe, or an asymmetry. He also reported a case of *megalophthalmos* in a forty-five year old Mohammedan. The condition was accompanied by unilateral corneal opacities and bilateral cataract. The right cornea measured 14 by 15 mm. and the eyeball 27 by 27 mm. Bilateral extraction was performed and the resultant vision was right 5/20 and left 5/30. **Begle** added a case of microphthalmos with *encephalocele* at the root of the nose. **Frenzel**, in a Leipsig dissertation, takes up the study of microphthalmos and high hypermetropia, and **Mazzei** reports congenital, bilateral microphthalmos.

A case of *enophthalmos* with retraction of the globe was recorded by **Rönne**. There were five distinct conditions that warranted the report: Congenital drooping of the lids, enophthalmos, paralysis of the external rectus muscle, retraction of the globe and nystagmus retractorius (Elschnig). An ocular anomaly never previously described was reported by **Gilbert**. It was a *melanoma,* clinically resembling a nevus pigmentosa, discovered by chance at autopsy. The melanoma sprang from a defect of the pigment epithelium of the iris and spread under Bruch's membrane. It also penetrated the iris thru a defect in the iris stroma and spread over the surface of the iris. A second type of pigment anomaly, occurring in albinos, was reported by the same author. The histologic examination of an albinotic eye corresponded to the findings reported by Fritsch and by Elschnig, in that there was a failure of development of the macula as well as poorly or even entirely undeveloped retinal pigment. The lack of macular differentiation explains the poor vision of such unfortunates. This is the third case thus examined.

Kafke reported a case of multiple *colobomas,* symmetrically arranged in both eyes. In addition, the right eye had suffered a lime burn some ten years previously. The corneas were vertically egg shaped, and the irides showed congenital coloboma downward. There was a nuclear sclerosis of the lenses with lens coloboma (the notched edge was downward). In the choroid were large colobomas below the disc, and the bottom of the depressions showed multiple levels. The vascular arrangment of the fundi was markedly anomalous. A second case by the same author had a nystagmus with convergent strabismus. There was a bilateral microphthalmos with marked microcorneae and persistent pupillary membranes. In the right eye, there was an atypical coloboma of the choroid from the macular region extending into the periphery. In the left eye there was a small coloboma of the choroid under the macula.

In a pair of brothers, twelve and a half and eleven and a half years old, **Purtscher** found identical anomalies in the form of bilateral *nystagmus* of both the pendulum and rotatory type. The right eye in both cases was amblyopic, altho the fundi were normal. The left eyes showed microphthalmos of a moderate degree with congenital corneal opacities. In both boys, the left half of the face was somewhat distorted. It was considered that all of these pathologic features were due to coordinated retardation, probably caused by an inferior type of "anlage" of the original cells in question. **Mackay** showed some congenital anomalies falling into three separate types. One was two children with microphthalmos, out of a family of four. The second was a case of injury to a congenitally illdeveloped eye, resulting in a band shaped keratitis. The third was congenital nystagmus of unusual rapidity.

Mertins described a case in which both eyeballs advanced fully six millimeters, upon opening the eyelids for ordinary examinations. No abnormality of the eyes could be found.

PHYSIOLOGY. — In a preliminary paper, **Priestley Smith** described an unusually interesting series of experiments performed upon albinotic rabbit heads, in which he endeavored to reconstruct a line of intraocular pressure, utilizing the blood that filled the head when the rabbit was suspended by the feet. Altho he was not successful in his endeavor, he considered that the experiments justified further work. As a part of the article, he made an anatomic comparison between the human and the ox eye. **Rados** examined the second and third *aqueous* after puncture, but was not able to show any increase in the index of refraction. However, amino acids were found that could be calculated in terms of glycocol-amino acids. The Greeff vacuoles in the ciliary epithelium were not present, and the author considered them to be present only in animals (thus showing a colloidal formation of aqueous), or in humans in cases of inflammation or glaucoma.

TRANSPLANTATION OF EYEBALL.—**Koppanyi** gave several resumés of his published work on the transplantation of eyes and their functional possibilities, a series of experiments that have aroused enormous interest in the past year. His first transplantations were those of the entire eyes of salamanders with seeming restoration of function. In the Spring of 1920, he started the transplantation of rats' eyes into rats' sockets previously prepared, the eyes being obtained by a very rapid enucleation. The eyes were held in place by a lid suture that was removed after twenty-four hours. At first the pupils of these eyes were widely dilated. In seven to nine days, the first faint corneal reflex began to appear, followed shortly afterward by the beginning of the pupillary reflex. The latter required some six to eight weeks before it assumed its full function. Eventually, rats with bilateral transplantation showed complete corneal reflex, pupils that responded normally to light, and further evidences of vision by jumping actively from one cage into another, a feat that the blind rats refused to attempt. Needless to say, many eyes were lost in the experiments, as not every transplantation was successful.

Some of the succesful cases were studied anatomically by **Kolmer**, who found that in the majority, the retina was completely degenerated. But in one case with good pupillary reaction and seeming vision, the retina was normal except for a slight area of degeneration immediately around the disc. Ganglion cells were present and axis cylinders could be traced from them to the disc, thru the optic nerve stump to the chiasm, where they were lost in the optic tract. In the transplanted salamander eyes, the retina was usually found to be in good condition, altho as a rule some pigment had wandered in, so that it resulted in an appearance resembling a retinitis pigmentosa. The nerve fibers could often be traced from the retinal terminal to the chiasm.

ENUCLEATION OR EVISCERATION.—The question of the advantages of enucleation over evisceration and vice versa is still unsettled in the minds of some ophthalmologists and leads to frequent discussion. **Dameno** presented his views on the subject, stereotyped for the most part, and laid down the indications for the one operation or the other. By severing the internal rectus first in enucleation and utilizing the stump of this muscle as the point of traction, and further by introduction of the scissors from the nasal side, **Yves** believes he performs a cleaner operation, especially in cases with myopic or staphylomatous eyes, leaving the socket in better condition. **Ralston** is strongly in favor of implantation into the capsule of Tenon, considering that this method gives the best results from every standpoint. **Castroviejo** considers enucleation the most scientific and safe course to persue in panophthalmitis.

The report of a good result obtained by the implantation of a glass sphere into Tenon's capsule was made by **Wood** and another by **Ellett**. **Offret** had similar results. **Stanford** is much opposed to any implantation within the scleral capsule, but believes that implantation, especially of glass balls, within Tenon's capsule yields the best effects from a cosmetic standpoint. From the scleral implant, he fears a sympathetic ophthalmia. On the other hand, **Carrasco** reported seven cases of implantation of a gold ball within the scleral capsule with excellent results. He used a slight modification of the Dimitry technic. **Parker's** experience with the Dimitry modification of the Mules' operation has been very satisfactory, except in two cases of panophthalmitis, where the implant was extruded. He was troubled by the amount of bleeding that occurred before the implant could be inserted; so he conceived the very novel idea of keeping the scleral cavity clean by means of an eyedropper attached to the ordinary negative pressure apparatus. **Calhoun** has written on enucleation of the eyeball and its substitutes.

Prothesis.—During the war, **Valois** and **Lemoine** employed *scleral grafts* in the depths of the orbital cavity to make a semirigid, yet mobile floor. They attached the four recti muscles to this graft. The original technic was naturally very crude, and it has been refined in the following manner: The eye is enucleated in the usual manner. The anterior portion is then cut away and the posterior portion turned inside out in order that every bit of uveal tissue may be curretted away carefully. The scleral shell is then replaced and sutured to the conjunctival lips of the wound. The authors claim that this operation gives the best possible results from all standpoints, is much more rational than the insertion of any foreign substance and completely eliminates the danger of sympathetic ophthalmia.

From 1914 to 1919, in the Elschnig Clinic, as reported by **Steiner** *fat implantation* was performed in 126 cases out of 422 enucleations and in 67 cases out of 242 eviscerations. A tabulation of the important features of the fat implantations could be made as follows:

	Enucleation	Evisceration
Total number ...	126	67
Fat healed in....	112 or 89%	57 or 83 %
Fat extruded.....	4 or 3%	5 or 8½%
Result unknown..	10 or 8%	5 or 8½%

In two of the cases of fat extrusion after enucleation, the bad result was due to the fact that the implantation was made in freshly wounded, acutely inflamed eyes. In the other two cases it was probably due to the character of the disease, for which the enucleation was performed. The causes of the extrusion of the fat after evisceration were: acute infection, absolute glaucoma, atrophia dolorosa, and phthisis bulbi. In 37 cases, there was sufficient shrinkage of the fat to warrant a secondary injection of paraffin, in some cases one to five years after the primary operation. In each case, the cosmetic result was improved. The only absolute contraindication to fat implantation is the presence of acute infection in the eye or orbit. A relative contraindication is that the healing process is some five to seven days longer, thus introducing the economic element.

Lewis reported a case of enucleation with fat implantation for cosmetic purposes, with excellent results. **Sattler** is inclined to the belief that fat within the scleral capsule eventually becomes necrotic and shrinks to almost nothing; whereas this does not occur to such an extent in Tenon's capsule. Any shrinkage that may occur does so in the first six to eight weeks, and usually follows hemorrhage which interferes with the nutrition of the implant. He showed some Roentgenograms to prove that the implantation of fat into the orbit of children where enucleation was necessary, resulted in a symmetric development of the orbits, in contradistinction to the usual asymmetry that follows removal of the eyeball without implantation. Fat was also implanted by the same author into the upper lid, to eliminate the sagging that frequently follows an enucleation.

Steiner reports the results of the implantation of fat in enucleation and exenteration in the Prague Clinic. In 126 enucleations the fat healed in place in 89 per cent; in 3 per cent it was expelled, and in 8 per cent the results are not known. In 67 exenterations the fat healed in place in 83 per cent of the cases, and was expelled in 8.5 per cent. In the negative cases the eyes were inflamed, perhaps explained by the persistence of microorganisms in the scleral capsule, and on the other hand, by insufficient nourishment of the sclera. In 37 cases observed for 5 years the fat shrank to one-half its bulk in 50 per cent of the cases; in the other 50 per cent it was slightly diminished. Where the shrinkage was extensive, from 0.5 to 1 c.c. of melted and just hardened white vaselin was injected into the stump. The fat was taken from the gluteal region or from the abdominal wall. In exenteration a square piece of the cornea was excised, 4 corresponding flaps of sclera were made by incision, and these were crossed and joined in couples over the fat. Because of the growth of the side of the face affected, implantation of fat is indicated in children. Cure results in from 9 to 12 days.

Liebermann writes on plastic enucleation as practiced by Sondermann, and **Takats** on plastic operation after enucleation.

PANOPHTHALMITIS. This is divided by **Fava** into three etiologic types: (1) traumatic, (2) Due to corneal lesions, and (3) metastatic or endogenous. The first is by far the most commonly met with type. The majority of cases are caused by aerobic organisms or even by saprophytes. But he reported a case in which the bacteriologic examination revealed *bacillus perfringens,* an anaerobic germ. A case of *pneumococcus* panophthalmitis which developed in a negro after the crisis of his double pneumonia had passed was detailed by **Touzet. Stargardt** operated upon a patient for detachment of the retina and shortly afterward a panophthalmitis developed. It was found to be due to a gram negative *diplococcus* which crammed the leucocytes. This organism differed from any hitherto described and belonged to either the gonococcus or meningococcus group.

A piece of button pierced the eyeball of a patient and a panophthalmitis developed. During the enucleation, **Byers** found the button while severing the optic nerve. **Cook** recited the details of a case of monocular panophthalmitis which is claimed to have been of endogenous origin. A patient seen by **Jacoby** confessed to a primary luetic lesion in 1920. The spirochetae were then found, and he was given thoro arsenic and mercury treatment. In July, 1921, a moderate panophthalmitis developed without any history of injury. The Wassermann at that time was negative. A month later the eye was enucleated and extensive adhesions of the globe to the orbit were found. Shortly afterward, in the other eye he developed an acute iridocyclitis that yielded to salvarsan. At histologic study, the panophthalmitis was shown to be an endo- and perivascular process, with plasma cell infiltration and a gumma of the retina and choroid near the disc. There was a destruction of all of the retinal elements. A thoro search with the Levaditi stain failed to reveal the presence of any spirochetes.

Coulomb advises wearing an artificial eye day and night, provided it is of the reform type. Prothesis should fit tightly against the posterior surface of the conjunctival sac, so tightly that fluids cannot penetrate the crevice and cause maceration of the tissues. Such an eye should be so large that it cannot be removed comfortably.

A young man with one eye injured some twenty years previously in childhood was seen by **Wessely.** A roentgenogram showed a very markedly *small orbit* of that side. This led to the experimental removal of the *Harder gland* from the orbit of a three weeks' old rabbit. The gland did not recur. Some nine months later, the eyeball was removed and the orbit measured. There was a noticeable retardation in the growth of that orbit, but to compensate there was an increase in the size and volume of the eyeball on that side. In a second series of experiments, the superior rectus muscle was removed in a series of three weeks' old rabbits and nine months later, the eyeballs were removed and measured. There was not a particle of difference found in the size of the eyeball or the radius of curvature of the cornea between the operated and unoperated sides, showing rather conclusively that the muscular effect has no influence upon the growth of the eye.

The Lacrimal Apparatus

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This section of the Digest carries the literature from July, 1921, to July, 1922. For previous references see O. L., 1921, v. 17, p. 362.

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DIGEST OF THE LITERATURE.

ANATOMY AND DEVELOPMENT.—**Schaeffer** gives possible anatomic and embryologic reasons for certain anomalies and variations in the anatomy of the nasolacrimal passageways. He urges considering clinically the importance of the particularly anatomic type, as in cases where there are diverticula, or where the nasolacrimal ostia are too small, they will not yield to operative treatment. The measurements of the *lacrimal canal* by **Santos-Fernandez,** by comparative measurements, brought out the fact that the canal is longer, narrower, and more crooked in the white race than in the negro; which he thinks accounts for the frequency of affections of the lacrimal passageways in the white race and its extreme rarity in the negro, whose duct is straight, wide and short.

Van der Hoeve, in reporting on persistent facial slit and the origin of the tear ducts, showed photographs of a child, on the left side of whose face the facial slit had remained partly open, and had produced a large coloboma of the lower lid. The lower punctum was situated to the temporal side of the coloboma. Altho this congenital deviation seems to prove that the canaliculi originate from the lid margins, Van der Hoeve still accepts the opinion of **Ask,** that the canaliculi originate as shoots from the lacrimal sac, and he showed specimens of **Ask's** to substantiate this. His own conclusions were: 1. Ask's investigations of the development of the lacrimal caruncle explain some congenital aberrations. 2. Most often facial clefts are of secondary nature, and caused by amnion bands. 3. It is possible to point out, by appreciating the conditions of the lacrimal canals, the nasolacrimal ducts and the caruncle, the time at which the amnion bands have exercised such an influence, that they formed impassable barriers for the lacrimal ducts or caruncle.

ANOMALIES.—**Chance** showed a case of supernumerary punctum and canaliculus in a girl who had been under treatment for dacryocystitis, which had been relieved by extirpation of the lacrimal sac. During dissection, it was noticed that an additional punctum was present in the lower lid, which communicated with the canaliculus by a narrow tube. The canaliculus itself had been slit by another surgeon. A probe inserted could enter the canaliculus, but not directly the lacrimal sac, there being no communication obtainable into it. The opening of the extra tube was distinctly ciliated, and led off at about 4 mm. from the normal punctum. It could readily be perceived when a solution of fluorescein was allowed to flow from the conjunctival sac. **Hertz** reported a case of supernumerary canaliculi.

McMurray reports two cases of *congenital stenosis* of the nasolacrimal duct with spontaneous recovery. Both cases had only one eye involved, and the condition began when the patients were only two and three weeks old respectively. One case was under observation for 2 1/2 years, and the other for 3 years. Treatment was expression of the contents twice daily and instillation of argyrol, looking toward operative interference when the patients were older; but before this could be done, both ducts opened spontaneously, with complete cure. The question arises how long should one wait for such spontaneous opening?

Gradle reported a case where the puncta were closed with a fine epithelial membrane, in a young woman of twenty, who had always had tearing on that side. Opening the puncta with a Graefe knife permitted fluid to pass into the nose, which condition remained permanent. The tearing stopped.

A patient of **Wagenmann**, a farmer, 64 years old, who, owing to a chronic catarrh of the respiratory passages, was subject to frequent attacks of coughing and sneezing, gradually developed on the right side a high degree of ectasia of the tear sac with cystic dilatation. This extended to and ballooned up the lower eyelid. He also developed a moderate ectasia of the tear sac on the left side. The cystic dilatation contained only air. On compressing the cyst, the air would escape with some noise, but without signs of the slightest secretion. After each new coughing or sneezing spell, the cyst would refill and become very tense. Examination of the cystic sac after extirpation showed no changes in its walls or lining. The slight redness of the outer skin of the lid, which was noticeable only during distention, was due to passive congestion.

A peculiar anomaly of the lacrimal passageway was seen by **Pichler** in a man who was able to force air thru the left tear duct, escaping thru the lower punctum with a whistling noise, audible at a distance of several paces. When the eye was covered by an eye cup, the noise ceased, but bubbles emanated from the punctum. He does not explain the reason, but it seems there must have been an unusually wide opening, with the valve of Hasner missing.

THE LACRIMAL SECRETION.—As studied by **Rötth**, the lacrimal secretion yielded the average values of a common salt content of 0.948%, and an albumin content of 0.4%. Anemia was produced by means of tonogen; by traction on the skin of the exterior canthus of the eye, a conjunctival pocket was made and the tears which accumulated in it were drawn off. The stimuli employed included: conjunctival corneal stimulation by drawing down the upper lid and drying; 2 inhalation of concentrated ammonia; 3. irritation of the retina by looking at the sun; and 4, psychic stimulation. In the first case, the refractometric examination gave an index of refraction between 1.3361 and 1.3379, which fluctuated for the individual case. The albumin content changed to an almost parallel degree; the concentration of the salts also changed correspondingly, but to a lesser degree.

The difference observed in various experiments appeared to be due to the addition of conjunctival secretion, as they were smaller when the conjunctiva was rendered anemic. The longer the conjunctiva was stimulated, the greater the extent of the adulteration by conjunctival secretion; this was experimentally proven. The index of refraction increased with the duration of the flow of tears. The average values did not differ with the various stimuli employed.

Charlton supports and expands his views, previously expressed, with regard to the protein content of the lacrimal secretion (v. 17, p. 265). He also points out the great similarity of innervation and secretion that exists between the lacrimal and salivary glands. He suggests that the influence of globulin in the tears may be a factor in the prevention or production of xerophthalmia.

PAIN AND LACRIMATION WITH MOVEMENT OF JAW.—The patient in whom **Gabriélidès** observed this condition was a woman of 48, who for 2 months had noticed on the left side pain in the eyes and lacrimation during mastication. These had become more and more severe. The pain was localized in the eye and frontotemporal region, did not extend to adjacent parts. For some days it had been so intense that she avoided eating, speaking and yawning. There was no abnormality of movement of the eyes or lids or of the neighboring parts. There was, however, on the left side a slight pseudoptosis and enophthalmos; and a slight edema of the skin of the upper lid after the attacks of pain. The pain began with a sensation of heat in the parts, and there was a slight redness recognizable only by very close examination. The sensibility of these parts was normal, as was also vision and the other senses. The pupils were normal. Lateral movements of the inferior maxilla, either passive or active, were followed by pain and lacrimation. The patient had lost all her teeth but four, and these gave no evidence of connection with the disease. But her fingers showed evidence of a generalized chronic nodular deforming arthropathy. Study of her general condition showed a history of malarial fever, but no other indication of disease. Two days later, the pain continuing as severe as ever, she was given morphin and urotropin. After that she did not return, but subsequently was found to have gradually grown better until fully recovered. It was supposed that the symptoms, which pointed clearly to involvement of the sympathetic nerve, were brought on by pressure of a nodular deposit similar to those on the fingers for which the urotropin was given.

A diagram illustrating the nerve paths thru which the action on the lacrimal gland and neighboring parts might have been brought about illustrates the paper.

ALTERED SECRETION.—In testing the power of various irritants to produce lacrimation for purposes of war, **Dufraisse** and **Bongrand** found that the effect was not always immediate, and that the stronger the concentration, the quicker the reaction. They realized the errors which might occur, due to the personal equation of the subject as well as the observer. They found the following relative effectiveness of various tear gasses used during the war:

Iodure de benzyle	2.0
Bromocetone	1.8
Bromure de benzyle	1.0
Oxide de methyl debromé symetrique	1/4
Chloropicrine	1/6
Chlorocetone	1/8
Veroleine	1/10

Epiphora arising from an ear condition is discussed by **Pugnat**. Congenital paralysis of the 5th nerve and total *lack of tears* was reported by **Kayser** in a boy who died at the age of three and a half years. Corneae and conjunctivae were insensitive, palpebral fissures wide, lids not covering the cornea, with scanty winking. Tears were never observed, and moisture of the conjunctiva was very slight. Etiologic factor was probably congenital central defects; as the development of body and mentality were slow and his maternal grandfather died of tabes, and the paternal grandfather from progressive paralysis.

Strebel, after a general review of *lacrimal cysts*, reports two cases of small cysts of the lacrimal gland due to obstruction of the excretory ducts, which caused epiphora. Both were cured by piercing with a needle.

DACRYOADENITIS.—**Key** presented a patient with bilateral dacryoadenitis. When first examined at 16, she had inflammation of both upper lids. Had had tonsillitis and gonorrhea previously. No other history of importance. Both lacrimal glands were enlarged, firm and tender. There was limitation of movement outward and upward, with displacement downward and inwards. There was no other glandular involvement. The condition cleared up in ten days. Key regards this as a case of lacrimal mumps.

The patient of **Cooper** was a woman of 51, who had teeth extracted and others treated on account of general health one year before. She returned with swelling of the sublingual salivary glands, which gave no trouble after omitting her dental plate. Then she had some fever, persistent conjunctivitis and mild nephritis, and later swelling of both parotid glands to almost the size of a fist. A little later symmetric swellings were noticed in the upper lids over the lacrimal glands. The glands and the general condition of the patient improved under vaccine obtained from an enterococcus found abundantly in the feces. The case was regarded as one of Mikulicz' disease.

A case of acute dacryoadenitis with exophthalmos, occurring in a young woman of twenty with pregnancy, was reported by **Laffont** and **Clergerie.** There was a history of tuberculosis in the family. After the ovum had been expelled at six weeks, which had been preceded by fever, the pain and lacrimal gland swelling disappeared, as also the exophthalmos.

A case of symmetric cystic enlargement of the lacrimal glands due to *syphilis*, in which there was a ++++ Wassermann, disappeared entirely upon administration of one injection of 606 by **Cowper.**

Beauvieux and **Pesme** report a case of this rare affection in a patient of 41 years with the clinical and pathologic findings, from which the following conclusions were drawn: (1) *Tuberculosis of the lacrimal gland* is a very rare affection occurring in 2 clinical forms: (a) exceptionally the caseous form: (b) more commonly, the sclerotic form. (2) It occurs in young persons or adults apparently free from tuberculous taint. (3) The glandular infection is of hemotogenous origin; secondary to an evident lesion or to an unknown focus. (4) It is of an attenuated variety, characterized by an infiltration of perivascular inflammatory cells, with the presence of typical or atypical giant cells. Sclerotic fibrous tissue predominates, forming a barrier to infection and limiting it to a circumscribed area. The almost constant absence of the bacillus of Koch is noted. (5) The attenuated tuberculosis of the lacrimal gland shows itself in the form of a hard tumor, slightly irregular, mobile, painless, growing slowly, unilateral or bilateral. (6) Local prognosis is good; general prognosis depends on the degree of the tuberculosis of the subject attacked. (7) The affection may be confounded with benign tumors of the lacrimal gland (adenoma, adenofibroma), and above all with simple sclerotic hypertrophy (chronic dacryoadenitis), which it resembles even histologically. The diagnosis can only be established by inoculation of the guinea pig. (8) Treatment may be expectant because of the possibility of spontaneous retrogression. The only rational treatment, however, is extirpation of the neoplasm.

LACRIMAL PASSAGES: — DIAGNOSIS: **Rochat** believes that being able to wash fluid thru the canal into the nose does not prove that there is no obstruction, as he has found cases of tearing where he was able to do this. He experimented with measuring the amount of pressure necessary to force fluid into the nose from the canaliculus, and found that in a normal passageway, the fluid went thru with a moderate amount of pressure, 17 to 22 cm., which was constant. When there was obstruction, the fluid would often come thru, but required pressure as high as 60 cm., altho syringing did not produce the sensation of abnormal pressure.

Roentgenograms, according to **Gangelen,** give an excellent view of the diseased lacrimal ducts, with the secondary changes in the lacrimal sac which can be caused by a stenosis of the duct. Formerly the lacrimal sac was completely removed, but nowadays a new connection between the lacrimal sac and the nose is made possible by operation. The roentgenogram shows the place where contraction has taken place, and eventual changes of form which the lacrimal ducts have undergone. Besides, the operator gets an idea about the size of the lacrimal sac.

The lacrimal sac is emptied as much as possible. The picture must be taken immediately after an injection has been made, as a part of the fluid very soon flows back to the corner of the eye. For impenetrable substance barium sulphat was used. In order to get a suitable powder, the barium sulphat is poured thru a filter with fifty holes per longitudinal centimeter. This filter, known as B 50 in pharmacy, gives a very fine powder, insoluble in water. A mixture with two parts of water is made and shaken. It can be used after sterilization, and is easily introduced thru the nozzle of Anel's probe. A mixture of this powder with water contains more ray averting substance per cubic centimeter than the usual fluids containing paraffin. The great percentage of powder per cubic centimeter is well suited for the lacrimal sac, as such a mixture does not flow back so rapidly as fluids of lesser specific gravity.

If the barium sulphat can be used instead of cerium or thorium oxid, the author recommends a change of the direction in which the pictures are taken. They have been taken in two directions, viz., frontooccipital and bitemporal. For simple irradiation the bitemporal direction is to be preferred, as the rays in this direction have to penetrate the thinnest layer of bone. In order to get a clear picture showing the size of the lacrimal sac, this should be placed as near as possible to the plate; the relative size in the picture will then best resemble the real size. For this purpose **Gangelen** used Rhese's position.

Pictures taken according to Rhese's method show also the changes of form. An expansion of the sac occurs usually in frontal direction, as the lateral nasal wall hinders an expansion in the medial direction. In the occipital direction the crista lacrimalis posterior is an obstacle, and in a lateral direction the sac is surrounded by the periorbita, which is stretched between the anterior and posterior cristae lacrimales. The expansion occurs more often in the frontal than in the lateral direction. These expansions can be seen on the plate, if Rhese's position is used.

Etiology of Dacryocystitis.—The cases of dacryocystitis without total stenosis distinguish themselves, according to the experience of **Sonnen** and **Weve,** not only by the degree of resistance, but also by the discrepancies in the resistance of the lacrimal canal. On one occasion, when a patient complained of epiphora and a first investigation rather pointed to a defective "pump mechanism" than a higher resistance, the pressure was repeatedly found to be higher during following measurements, and even an apparently patent canal was found to be impermeable on a following day. This condition was not observed in normal persons. In pathologic patients, an acute dacryocystitis was seen repeatedly to go over into a dacryostenosis, while in normal persons, disadvantages due to repeated measurements could never be observed. Sonnen and Weve, therefore, agree with Rochat that epiphora should not hastily be ascribed to a defective pump mechanism. A full description of their determination of the resistance of the lacrimal canal is given.

Streptothrix.—Three cases of tumors of the lacrimal canal were seen by **Raynaut,** due to *streptothrix foersteri.* The bibliography is gone into extensively. He thinks one can easily confuse the diagnosis with actinomycosis.

Francke also reported two cases. In one, the accumulation occurred in the upper canaliculus of a man, and was easily expressed between the forceps and thumb without changing the punctum. The second case was in the lower canaliculus in a woman. Another case is reported by **Fava,** who lays stress on the clinical appearance combined with the microscopic picture, in order to make a differential diagnosis.

Caussade and **Tardieu** report a case of pneumococcus infection occurring with general pneumococcemia.

PLAUT-VINCENTI INFECTION. — The case described by **Loehlein** is one of dacryocystitis with copious secretion of watery pus; in a smear stained with Gram's solution, a few staphylococci and epithelial cells, and many leucocytes, light red spirochetes and various large forms of B. fusiformis were found. With the Giemsa stain, the spirochetes were very pale; with the Gram and Fontana stains, they showed strikingly changing length and thickness; with the Tusche stain, their tendency to form dense bundles was clearly shown. B. fusiformis varied from the short spindle form to the long bow shaped rods.

On extirpation, the lacrimal sac was found enlarged, with a firm occlusion where the sac opens into the nasolacrimal duct; nevertheless, the nasal duct was normal. In the silver preparation of the sac, spirochetes occur in the secretion filling the lumen, but never in the epithelium of the walls. Several days after removal of the lacrimal sac, the conjunctiva of that eye was healed; so the infection of the sac was not descending, originating in the conjunctiva, but was ascending, especially since the spirochetes and B. fusiformis are generally found in the oral diseases. The anamnesis never showed that the patient had trauma many years before, thru which a trivial injury to the bone in the vicinity of the lacrimal sac took place, or opened the way for the microorganism, found in the oral cavity, to enter the lacrimal sac. This case is the first in which the Plaut-Vincent organism, characteristic of angina, was found in the smear.

OBSTRUCTION.—**Le Boucq** reports six children born of healthy parents. of whom five showed, immediately after birth, a bilateral congenital lacrimal obstruction. The other one had an obstruction on one side only. Probing resulted in immediate cure in all the cases.

Villard divides his cases into three groups, in which the result of probe treatment is absolute, relative, or negative:

1 a. Dacryocystitis. Congenital: Results miraculous.

b. Epiphora, mild and recent: If it is a case of hypersecretion, probing is futile. If it is due to faulty carrying away, probing is useful. It is sometimes necessary to correct eversion of the punctum.

2 a. Mild epiphora. Catarrhal conjunctivitis, etc:

b. Mild dacryocystitis (recent) with mucous secretion.

3 a. Chronic suppurative dacryocystitis.

b. Acute dacryocystitis.

c. Tuberculous dacryocystitis.

d. Fistula.

TREATMENT.—The clinical manifestations and treatment of obstruction of the tear duct *in the new born,* is discussed by **Zentmayer,** who states when cystitis develops it is due to secondary infection. He thinks the usual cause is due to the retention of the separated epithelial cells which go to make up the core from which the canal is later developed, due to imperforation of the septum (Hasner's valve) between the lacrimonasal duct and the nasal chamber. Nature in time usually corrects the trouble, but at any stage, infection of the contents may result in the formation of an abscess. It seems wise at once to secure proper drainage by the passage of a small probe thru the dilated punctum, canaliculus, sac, and canal into the nose. Local anesthesia is required and generally one probing will suffice.

Heflebower has written a general paper on obstruction of the lacrimal duct. He thinks purely medicinal therapeutics are too often overlooked. Careful persistent attention to such measures is required.

A lacrimal sac abscess of traumatic origin was treated for a considerable time by **Sharp** with probing and antiseptics, but the results were not satisfactory and extirpation of the sac was performed. The wound healed nicely, but later broke down and a suppurating sinus was left, into which a probe could be passed for a distance of 12 mm. An autogenous vaccine was then prepared, the organism being the staphylococcus, and after two injections the abscess was healed.

No extravagant claims as to the infallibility of the use of *nascent iodin* in the treatment of dacryocystitis are made by **Lemoine** and **Valois**. In cases of long standing suppuration accompanied by ecstasia, ablation of the sac still remains the method of choice; but when the symptoms are confined to a simple hypersecretion of comparatively recent onset, conservative treatment is called for. Since 1912, the authors have been advocating treatment with nascent iodin. In several of their cases, a cure was effected after the condition had resisted all other treatment. They cite one case, in which the patient, four months after operation for a large mucocele, presented a fistula which discharged purulent secretion. Under treatment with nascent iodin, the fistula healed completely in one month. Nascent iodin is obtained by the action of a peroxid on an alkalin iodid. The salt is decomposed, liberating potash and iodin.

$$2\,KI + H_2O_2 = 2\,KOH + 2\,I.$$

This particular form of the metalloid exercises a beneficial effect, not only on the mucosa, but also on the deeper tissues. The technic is as follows: After cocain instillation and digital expression of the sac, an injection of 10% potassium iodid solution is made, by way of the punctum. Perfect mechanical drainage of the ducts is sought, and then a small quantity of oxygenated water is injected. The reaction is instantaneous, and the excess water which issues by way of the nostrils will be found to be tinged with yellow. The procedure is absolutely painless. To avoid any conjunctival reaction, a small cotton tampon is held near the lacrimal puncta to catch any liquid. It is also wise to follow the injection of medicament with a sterile water lavage of the lower culdesac.

Brandt and **Fraenkel** report one case of lacrimation cured by irradiation. After an endonasal operation and an extirpation of the left lacrimal sac of a 17 year old girl, the lacrimation did not cease, altho the incision healed without any trouble. The technic must be very exact; an obliquely cut lead tube with a diameter of 2.5 cm., which contains 2 aluminum filters, each 2 cm. thick, is placed in such a way that the rays on the inside travel from the bottom to the top obliquely on the outside, so that they do not strike the eye. Six sittings were given on two consecutive days, with an interval of one week between. Altho endonasal operation of a suppurating lacrimal sac undoubtedly produces good results, and will remain the most important method of treating this disagreeable disease, even the partisans of the method cannot deny that it sometimes fails to accomplish the desired result, at least in so far as lacrimation is concerned. Similar cases where extirpation of the lacrimal sac is indicated, or, where epiphora persists after endonasal treatment, may be treated by irradiation with X-rays, provided further investigations confirm the results obtained in the case reported.

In a case of chronic suppurative dacryocystitis, where operation for the extirpation of the sac was refused by the patient, **Pacalin** used Jocqs' method of cauterization with 50% zinc chlorid solution. The inferior lacrimal point was first slit open and access gained to the lacrimal sac. This cavity was packed with gauze soaked in 1:5000 mercury oxycyanid solution. The next day the pocket was cauterized with zinc chlorid, care being taken not to destroy the mucosa of the sac which adheres to the lacrimonasal groove, so that the tears might still flow out thru the nose. A piece of gauze soaked in the oxycyanid solution was again inserted after this application. When it was withdrawn on the following day, pieces of mucous membrane were removed with it, and it was found unnecessary to curet. A No. 2

Bowman sound was passed thru the lacrimal duct; this treatment was continued for ten days. A dry dressing was then applied and complete healing occurred. No scar remained. Several other cases have been treated by the author in the same manner. In the author's opinion, simplicity, the perfect esthetic results and the possibility of preserving in some cases the permeability of the lacrimal passages make it the method of choice.

PROBING.—**Heimann** has had excellent results in the radical cure of lacrimation by stricturotomy in more than 30 cases. His method consists in anesthestizing the lacrimal duct and introducing a medium sized Bowman sound, which is left in place a little while. Then the adhesions of the lacrimal duct are cut, and immediately afterwards a large Bowman's sound, 3 mm., in diameter, is introduced. This sounding is repeated once a week for 5 or 6 weeks. **Woodruff** has described small lacrimal duct curets.

The method of **Santos-Fernandez,** suitable for a clinic, is difficult in private practice owing to its painfulness; and its results are uncertain. In successful cases, it has not been necessary to insert the sounds more than 3, 4, or 6 times at the most, at intervals of one, two or three days. When it was evident upon the first catherization that the injection of liquid thru the tear ducts with Anel's syringe had passed into the nose or throat, success was sure to follow treatment; but when the water did not at once pass, the treatment was abandoned as useless. Fernandez has always, when feasible, undertaken an antiseptic treatment before and after catheterization, as the history is probably syphilitic. In cases of dacryocystitis, it is always important to see if the nasal canal is free, for the prognosis depends on this. If the tear duct is obstructed, removal of the inflamed sac is indicated.

INTRANASAL DRAINAGE.—A simplified intranasal operation for obstruction of the nasolacrimal duct is described by **Good.** The anterior end of the inferior turbinate is removed with bone forceps as close as possible to its attachments and just beyond the duct opening. A grooved probe is then introduced thru the canaliculus and duct into the nose. The mucous membrane is excised from high up in front of the middle turbinate down to just in front of the probe. The membrane is elevated, forming two triangular flaps. With a special chisel one-fourth of the circumference of the bone canal is chiseled away up to about the middle of the sac. A crow-beaked knife is then passed in the groove of the probe to divide the upper half of the sac and the duct. No after treatment is required. Good had not failed to restore function in any case in which this operation was used. He reports 5 illustrative cases.

Nowak reports his experiences together with **Ruttin** with the West operation. The operation was first resorted to in cases of chronic dacryocystitis with normal canaliculi and obliterated nasal duct, and normal condition in the nose. Later on, it was done in simple closure of the nasal duct and in one case of mucocele. The best results were obtained in cystic distention and simple stenoses, while chronic dacryocystitis without cystic distention failed to be benefited by it. The new opening was always visible at first, but disappeared later in the four oldest cases. It is too early to judge of the permanency of results. Bacteriologic studies showed that in the successful cases the previously present germs disappeared.

Campbell describes an easy method of approach in his operation of intranasal dacryocystotomy, by operating from the opposite side of the nose thru the septum. The usual incision for submucous resection of the septum, the mucous membrane reflected for about 1/4 in., then the cartilage and mucous membrane of the opposite side are cut thru, 1/4 in., together, posterior to the original incision. The septum is replaced after the operation without difficulty and a light packing introduced. The septal window gives a good avenue of approach to the anterior ethmoidal cells.

Heyminx describes in detail his operation of intranasal dacryocystotomy, a modification of the West-

Polyak operation. Cure was obtained in from 8 to 15 days. **Dupuy-Dutemps** and **Bourguet** report 43 complete and permanent successes from a plastic dacryocystorhinostomy. They emphasize the importance of complete coaptation of the mucous membrane of the sac with that of the nose.

Yankauer discussed the recent operative procedures for drainage thru window resections, and concluded that such procedures had usually failed to give permanent relief. He described his newer method of dissecting thru intranasal obstructions without disturbing the lumen of the lacrimal canal.

Ten additional cases have been reported by **Chamberlain** on the endonasal operation of the lacrimal sac (O. Y. B., v. 14, p. 162), with no failures. His operation is that of West with certain modifications, with which so far as restoration of the physiologic pathway is concerned, results have been uniformly good. **Weis** advocates extirpation of the lacrimal sac, but he operates intranasally. **Kraupa** prefers the Toti to the West operation, because radical removal of the lacrimal sac is not easy to perform, even when it is freely exposed to view, and the difficulties of the operation are still greater if it is performed intranasally; moreover, in the latter method of operating it is impossible to be sure of not injuring the orbit. The original West and Toti operations can be counted on for complete cure only in cases of simple lacrimation. **Richter** has pointed out the advantages of West's operation and described its technic.

Frieberg has operated on the lacrimal sac in 174 cases by West's method, and reports the favorable end results. The aim of this method of treatment is to free the patient of his subjective symptoms, and also to reestablish physiologic conditions as nearly as possible. Frieberg reports some functional failures, but he thinks they are not the fault of the operation, but are due to circumstances which have an unfavorable effect on suction in the lacrimal canals, or to excessive contraction of the operation wound in the nose. Therefore, before the operation, the functional capacity of the canal should be tested with West's probe; and various complications as, for instance, the inflammatory stage of trachoma and suppuration of the sinuses, are to be regarded as contraindications. Not only are many of the cases cured permanently by the first operation, but when operations for recurrence are necessary, permanent cure is generally brought about by this operation. By recurrence Frieberg means cases where the function restored by the operation is again destroyed by the formation of a membrane, which closes up the opening between the lacrimal sac and the nose. These recurrences generally take place before the end of the fifth month, occasionally between the fifth and tenth months, and never later than the tenth month. Therefore, he assumes that recovery is permanent if the duct is still open at the end of the tenth month.

These 174 cases were all caused by stenosis of the duct below the sac. Frieberg used West's method with some slight modification of his own. He does not have the patient sit up, but placed in a semireclining position; supplements local anesthesia with Seidel's conduction anesthesia; and perforates the bone, especially if it is thick and hard, at several points with a small dental drill, which makes it much easier to chisel the bone away. The entire wall between the nose and lacrimal sac is removed, as well as the ethmoid cells and the part of the middle turbinate that covers the lacrimal sac. It is important that the mouth of the canal be exposed.

The operation for recurrence, which consists in intranasal removal of the new formed membrane, is carried out under local anesthesia, combined with Seidel's conduction anesthesia and if performed five to six weeks after the first operation, all postoperative reaction is ended. The operation for recurrence is much simpler than the primary operation, the tendency to contraction is less, the prognosis therefore much better, and the after treatment completed within two to three days. There were 32 cases of recurrence in the 174 operations. Secondary operation was necessary in only 24 of these, and the permanent results were good in all. Even in the 8 cases which were not operated upon the second time, there was no reason for an unfavorable prognosis. In general, statistics show that only 6 or 7 per cent of cases operated upon are incurable, if after treatment is carried out properly; and that the intranasal operation, sometimes supplemented by an operation for recurrence, permanently cures uncomplicated cases of stenosis and dacryocystitis with a few exceptions, and also gives satisfactory results in complicated cases, such as phlegmonous dacryocystitis and stenosis in one canal. A previous Bowman's operation is not regarded as a complication if the slit in the lacrimal duct is directed backward.

The author compares the end results of the endonasal method with those of Toti's operation, which removes the wall of the nasal duct from outside the nose. Toti's operation is technically easier, pathologic changes inside the nose do not interfere with it, and it does not demand so great a degree of rhinologic training as does West's method. Toti's operation also gives good results; different authors have had from 58% to 73% of recoveries. But Frieberg thinks the endonasal method is better, since it gives 75% to 93% of permanent recoveries. This may be partly due to the fact that in West's method the orbicularis is not touched, and therefore functions after the operation just as it did before, while in Toti's operation the lesion of the soft parts is greater and the inflammatory reaction may cause cicatricial changes in the adjacent parts of the orbicularis to interfere with its function.

Resumé: The indications for the endonasal operation on the lacrimal sac are stenosis below the nasal opening of the canal, simple stenosis, and catarrhal and phlegmonous dacryocystitis. The operation is contraindicated in cases with defective function of the canals, lax eyelids, cicatricial changes of both canals, inflammatory trachoma, all cases where any kind of nasal operation is contraindicated, serpiginous ulcer, and previous operations on the eye complicated by dacryocystitis, where the function of the ducts is uncertain.

The endonasal method in treatment of the lacrimal sac is unrivaled. The rapid regression of inflammation is due to the fact that the lacrimal sac is constantly irrigated with tears, which have the effect of continuous irrigation of a suppurating wound with an antiseptic solution. An example of the antiseptic action of such an irrigation was seen in 3 patients after operation, where **Heermann** put a small strip of gauze in the lacrimal sac in order to prevent the opening from closing up. On changing the tampon, he overlooked the gauze and left it in place. He saw one of these patients four weeks later, another eight weeks later, and the third not until three months later, and when he removed these tampons, they had no odor at all. He recommends the intranasal operation in *tuberculosis* of the lacrimal sac, and describes a case cured by this method. He describes an oval speculum which can be held by an assistant, so that the operator has both hands free; also a chisel with a handle which does not interfere with the surgeon's view. The wall of the lacrimal sac can easily be grasped thru the window in the bone. If the wall is thickened, it can be pushed forward by a sound introduced thru the lacrimal duct, and can be cauterized over the head of the sound thru the nose. In practice, severe hemorrhage may delay the operation. In conclusion, the following points are emphasized: (1) In suppuration of the lacrimal sac, West's operation is the one which, if properly performed and if given proper after treatment, will maintain a permanent connection between the lacrimal sac and the nose. (2) Failures are due either to defective technic or to lack of persistence on the part of the patient. (3) The lacrimal sac should not be removed before a skilled surgeon has made repeated attempts to open it up thru the nose.

As by West's method of intranasal operation, devised in 1910, the mucous membrane of the lateral wall, together with the periosteum and quite a large piece of bone, must be chiseled away in order to reach the duct, and the latter then lies in a large defect of the bone, where granulation and pus form and cicatricial tissue may interfere with the results of the operation, **Halle** devised a modification in which he tries to preserve the mucous membrane of the lateral wall, and only takes away enough of it to form a window in the bone and mucous membrane, thru which the lacrimal duct may have sufficient communication with the nose. In his method it is not the duct, but the sac, which is exposed, and its median wall removed thru the nose. Halle earnestly recommends his method, which he used successfully on a child 3 1/2 months old, and even in a younger infant of 5 weeks.

The indications for intranasal operation on the lacrimal sac are stenosis of the duct, ectasia of the duct, dacryocystoblennorrhea, fistulas and foreign bodies. Abscesses and phlegmons in the region of the sac are not a contraindication. Anesthesia consists in painting the whole region of the operation with 10% cocain containing a considerable amount of suprarenin, and injection of 0.5% novocain-suprarenin solution into the mucosa of the lateral wall, and into the skin of the external nose as far as the lacrimal sac. Ten to fifteen minutes should elapse before operation. The instruments are a knife, and elevator, a chisel and a lacrimal sac forceps. This operation offers no difficulty to a skilled rhinologist, but for the ophthalmologist, Toti's operation is to be preferred.

THE EXTERNAL OPERATION.—In an interesting report of the results of the anastomotic method (Toti) in lacrimal obstruction, **Davies** describes minutely the technic of the operation and sums up his results in 56 operations under three headings: Complete cures, partial cures, and failures. He considers a perfect cure a case in which after operation there is no epiphora and fluid passes easily to the nose on syringing thru the canaliculus; a partial cure, in which there is no watering of the eye, and yet fluid cannot be passed into the nose; and failure, in which watering of the eye and complete obstruction of the newly formed passage have occurred. Under this classification, 36 of his cases were cures, ten partial cures, and ten failures. Immediate results are not always good; one has to wait three or four months before being certain of a cure.

Ohm performed Toti's operation 70 times during the last eight years. The youngest patient was 5 and the oldest 62 years of age. Eight times he performed the operation on both sides in the same patient. In most of the cases the patients were suffering for years from a suppurating lacrimal sac, which had been subjected to treatment with optochin, washing and sounding of the sac. In some cases, prior to operation, he resorted to slight dilatation with the conical sound, or with the lacrimal fistula knife, for the purpose of enabling him to wash out the canal. In some, the lower part of the duct was slit open as far as the sac. In 3 cases there occurred a lacrimal fistula, and in 2 a severe dacryocystitis.

In one of the latter, the patient at first refused a Toti operation, but after several attempts to relieve him by incision had failed, a Toti was finally performed. In the other case the eyeball had been pushed to the outside and anteriorly; Ohm therefore incised the inner wall of the sac, without touching the sac itself, and tamponed the wound for nine days, after which the swelling around the eyeball subsided. After this he established communication between the sac and the nasal cavity. In 2 mountaineers, there occurred a traumatic enophthalmos with closure of the lacrimal canal after an injury. In one of them, the bone was decayed and fissured. In a soldier, both sacs were injured by a bullet passing thru them. A bilateral operation was successfully performed.

The essential part of the operation consists of an exact splitting of the sac with preservation of the duct and close approximation of the edges of the wound, wherever possible, by means of sutures. When the operation is carefully performed, there results in most cases a small and almost invisible scar.

Dacryocystitis, according to **Ohm**, is no reason for performing an intranasal operation. A few days of conservative treatment by means of a 10-20% solution of silver nitrat (pencilling), will be followed by a healing of the skin, after which the Toti operation may be undertaken. There is no uniformity of opinion as to the extent to which suppurations of the accessory sinuses of the nose are responsible for suppurations of the lacrimal sac. A dacryocystitis sometimes develops after operations on the maxillary and frontal sinuses, and on the other hand, an inflammation of the lacrimal gland may recede after recovery from an operation on the maxillary sinus. The treatment of dacryocystitis has undergone a change, as sounding has been to a certain extent discontinued. Slitting of the lacrimal duct has been given up, as has also extirpation of the lacrimal sac, as a mutilating operation, especially in serpentine ulcer of the cornea, or before an operation on the eyeball.

Von Eicken speaks of the great popularity of Toti's operation, and the good results of West's, Polyak's and Halle's methods, as well as of the transseptal method of Kofler. West had 90% recoveries in 480 cases; Frieberg 82%. Polyak's results were about the same. Veis has described a somewhat different method of operation that culminates in the extirpation of the whole lacrimal sac. The author criticizes the fact that the lacrimal duct is not involved in West's, Polyak's and Halle's operation, as it is in the premaxillary method, and he therefore prefers the latter methods. The slight modification of Kutvirt is possibly justified if the nasal opening is very narrow. The author welcomes the cooperation of rhinologoists and ophthalmologists in this field.

The procedure followed by **Zarzycki** takes the ocular way for the trephining of the lacrimal canal, and the nasal way for obtaining an opening in the inferior part. The technic is thus described: Nasal tampon of gauze on that side to prevent blood from entering the cavity. Incise the inferior lacrimal punctum down to the sac, with the Weber knife. Seek the entrance of the canal with a probe (Bowman), and make note of the size of stricture. With a short, thin bistoury make a vertical incision, and in the form of a T, from the inferointernal border of the sac just to the beginning of the canal; then, with a small curette dissect up from the unguis this incised part of the sac. Trephine with the burr or chisel thru the unguis toward the inferior part of the cavity of the sac, being careful to keep the instrument against the middle of the superior orbital arch. If the inferior turbinate is hypertrophied, a partial resection is done. Orbitonasal drainage is made with a small fenestrated rubber drain, introduced like a probe. A dry dressing is placed over the eye. At the end of forty-eight hours, the nasal cavity and the eye dressing are renewed, after cleansing of the conjunctival cavity. A few drops of argyrol are instilled in the eye, and the interior of the drain cleansed by the aid of a Pravaz syringe. Dressing should be done every two days. In thirty cases operated upon by this method, the results have been satisfactory.

Knutson gives an account of 61 cases of dacryostenosis and resulting complications which he has treated surgically according to West's method, and systematically examined for a certain length of time afterward, in order to observe the functional result. The time of observation has varied between two months and two years and five months, and results are presented in three tables. Table 1, comprises all the cases of dacryostenosis, with or without secondary affections and shows that cure of the lacrimal duct affections occurred in 77-80% of the 61 cases operated on with or without revision.

In table 2 are brought together cases of simple stenosis and of catarrhal dacryocystitis, and in table 3 purulent dacryocystitis and cases with cicatrices and fistulas resulting therefrom. The effect of the operation in the former group is much more satisfactory than in the latter, 89% of cured cases as against 55-60%. In group 2, all the recurrence operations have succeeded; if it had been possible to reoperate upon all these cases, the final result might have shown healing with good function in 100%.

In group 3 almost all the recurrence operations have been unsuccessful. This difference cannot be explained by defects of technic only; the same surgeon has operated on all cases, and the unsuccessful cases are found as much toward the end of the series as in the beginning. Cases that have given a bad surgical result are chiefly those in which the function of the canaliculi can be expected to be checked or to have ceased. Operation is indicated even in those cases where this function appears to be disturbed and the prognosis with regard to the restoration of lacrimation toward the nose not sufficiently good, in order to quickly and relatively painlessly relieve the patient from acute inflammation in the immediate surroundings of the lacrimal sac, and from fistulas. External extirpation of the lacrimal sac becomes the only rational measure in such cases, if the endonasal operation has failed.

Lange reports the results in 29 cases of Toti's operation, 20 of the patients being women. Local anesthesia was used, and the skin incision made midway between the bridge of the nose and the inner angle of the eye. In 23 of the 29 cases, there was complete restoration of the flow of tears. Careful after treatment will increase the number of cures. The external skin wound gradually becomes movable again. There is no external deformity. The author advised all specialists who have not acquired great skill by frequent endonasal operation to choose Toti's method. It is easier and gives a better view of operation than the Polyak-West method. Fissure and stenosis of the lacrimal ducts or severe progressive disease of the nose are contraindications to Toti's operation, which aims at free communication between the lacrimal sac and the nose.

Kutvirt's method of operation after elevation of the soft parts of the lips and nose, opens the bony duct from the mouth, removes the sacs and ducts, and opens an aperture into the middle meatus. **Sievert** and **Gumperz** claim for it the following advantages: No external scar results, there is not, as in Toti's operation, any injury to the canaliculi, and, above all, the field of operation is at all times in full view, which is a great advantage over West's operation. Local anesthesia, accurately carried out, is of paramount importance for the success of the operation. The after treatment is very simple in all cases; no irrigations or cleansing processes of the nose are made. Healing takes place spontaneously. Beginning with the second week, an occasional introduction into the nose of pure vaselin is of help in reducing the slight crust formation at the site of operation. It was never necessary to use either chemical or galvanic cautery, or to introduce bougies.

The authors report on the result of 26 operations; 12 cases of simple dilatation were all cured, likewise 4 cases of dacryophlegmon in which the operation was performed five days after a percutaneous opening of the phlegmon. Of 3 stenoses, 2 were cured at once, and one subsequent to a brief special treatment for stenosis at the end of the duct. Two cases of atrophic rhinitis resulted in cure. But of 2 stenoses with broad slit ducts, only 1 healed, while epiphora persisted in the second. A case of cicatricial formation, which had thrice been treated by extirpation, remained unhealed to date, but is still being sounded. In 1 case the operation revealed a bone defect, which led to the discovery of pus in the antrum. This case also resulted in a cure.

In stenosis and chronic blennorrhea, the authors employ conservative treatment, which, if unsuccessful, they follow by operation. A previous X-ray examination of the lacrimal sac and the accessory sinuses is useful. The radiogram is intended to show whether the remains of the lacrimal sac offers a sufficiently large field for a successful operation. Its second advantage is that it clearly shows not only the topography of the lacrimal sac, but the condition of the accessory sinuses, which are often diseased in affections of the lacrimal apparatus. The authors warn against slitting the lacrimal ducts and against the use of too thick sounds, which may result in injury to the ducts. **Aubaret** discussed indications for radical treatment.

Ball thinks it is not always wise to wait until fluctuation is present, but to slit the upper canaliculus, the knife being carried to the sac beyond and followed for a few days by probing and hot applications.

An operation similar to the method described by Burch before the Academy of Ophthalmology and Oto-Laryngology in 1920, is advocated by **McMillan**, in which the sac is dissected free and turned into the nose.

Mosher had made an exhaustive study of the various means for draining the lacrimal sac into the nose. He has performed most of the operations done by various surgeons, and has come to the conclusion that the method of Toti, slightly modified by himself, gives the most satisfactory permanent result and is the safest of all methods. He feels that there is a constant risk of infecting the contents of the orbit, if the intranasal operation is extensive, because he considers it a blind procedure compared with the combined external and internal operation. Even in his own summary of the situation, he admits that the intranasal operation is apt to leave less of a facial defect, and that if the intranasal operation fails, one can always fall back upon the combined operation.

Extirpation of Sac.—In summing up the study of 45 cases of extirpation of the lacrimal sac, **Gilbert** states that one and one-half years after the operation not a single case was free from epiphora, and it persisted for two to five years in fifty of the cases. In most of the cases the patients denied relief from the tears, and were willing to undergo further surgery for relief. He concludes that the operation of cystectomy, while of great value in removing a source of infection, leaves a troublesome epiphora in most cases. **Duverger** goes into detail, with numerous cuts, on the technic of extirpation of the sac. He feels that there are three types of extirpation. (1) Those where the sac is taken out by the dissection, where there had been no involvement of the surrounding tissue. (2) Where there has been one or more phlegmons, including the surrounding tissues down to the bony canal. (3) Chronic fistulas or tuberculous cases, where he includes part of the bony canal, part of the ethmoid and even chisels away part of the superior maxilla.

Even when dacryocystorhinostomy is properly performed, there is frequently recurrence of lacrimation and suppuration. This is due (1) to regenerative capacity of the bone in congenital syphilitics, in whom this disease occurs most frequently, and (2) to severe pathologic changes in the mucous membrane of the lacrimal sac after phlegmonous inflammation. **Kraupa** decided, independently of Blaskovics, to perform a total extirpation of the lacrimal sac from without, opening the nose and removing the diseased tissue. The lacrimal ducts empty into the nose and this makes free discharge of the tears possible and at the same time overcomes any reason for recurrence of the suppuration. The advantages of this operation are: It can be carried out without confining the patient to bed, gives a free view of the parts of the nose involved, enables the physician to remove the diseased tissue, and recovery is very rapid.

Wright compares the extirpation of the lacrimal sac as done by Greenwood with those of Meller and Elliot and comments favorably on occlusion of the canaliculi. He, however, makes his skin incision in such a way as to carefully avoid the angular vein. Cauterization of the lower part of the canal has been given up. A large sized probe is passed thru it, and the sleeve of mucous membrane invaginated by a few strokes with the curette. The operation as practiced at Madras takes 5 or 6 minutes and is practically bloodless.

An editorial in the Medical Record points out that destruction of a sac was first deliberately done in the 18th century by Nannoni. It has been superceded by removal. Extirpation should be done in the majority of cases of chronic dacryocystitis with or without fistula.

Diseases of the Lids.

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This section carries the literature from August, 1921, to August, 1922. For previous references see O. L., 1921, v. 17, p. 375.

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DIGEST OF THE LITERATURE.

ANOMALIES. EPICANTHUS.—Reports of the well known epicanthus medialis, frequently associated with other anomalies of the eyes and especially of the lids, are not rare in ophthalmic literature. All hitherto published cases of epicanthus corresponded to Ammon's general definition: a semicircular fold which, extending from the palpebral surfaces of the lid margin and eyebrows downward over the inner canthus, covers this in the form of a sickel and terminates usually below the lacrimal caruncle. **Braun** reports six cases, the peculiarity of which consists in this, that the fold of the skin arises in the lower lid, while the medial terminus embraces the unaffected upper lid in a small arc. The inner canthus is not covered by the fold; it is not, however, situated in its normal position, but is drawn outwards so that its distance from the bridge of the nose is greater. The necessary result of this is a narrowing of the palpebral fissure, which, moreover, runs somewhat obliquely from below and inwards in an upper outward direction. Complete congenital ptosis regularly accompanies this anomaly. The upper lid hangs smoothly down without folds. Without a trace of any covering fold, the vertical diameter of the upper lid is shorter than normal.

Such ptosis is undoubtedly due to a faulty development—aplasia—of the upper lid. The test of the sympathetic is sometimes positive, in other cases negative. Where the fold of epicanthus is large, the caruncle is wholly or in part covered by it; in many cases this structure is but ill developed. This form of epicanthus is not contained among the numerous variations which Ammon so fully describes, and no similar picture is found in his diagrams. Four illustrations accompany the description. All of the cases occurred in girls. No racial influence was present; there was a clear hereditary history. The cause of this anomaly is to be found in a general sparcity of the amnion, or in the presence of amniotic strands; the latter do not result in these cases in entire inhibition of union, but lead thru traction to delay in normal development. Braun also calls attention to the almost uniform astigmatism present in these cases; the stronger meridian is horizontal or nearly so. It appears that the unusual development of the lids, perhaps thru abnormal pressure, influence the curvature of the developing cornea. **Addison** and **How** have reported their studies of development of the eyelids in albino rats up to the state of complete disjunction. **Szekrenyi** has written on epitarsus.

RELAXED LIDS.—In **Chance's** case of a man, aged 60, the skin of the eyelids is so relaxed that that of the upper lid droops so far as to cover the fissure, while that of the lower sags in great masses; the deformity has been present since birth. It does not resemble blepharochalasis, nor is it of inflammatory origin, but seems rather to be the effect of a lack of elastic fibers in the skin.

FACIAL HYPERTROPHY.—**Brown** reported a case of unilateral facial hypertrophy in a boy aged 4 years. Examination revealed a ptosis of the thickened upper lid, and a marked prominence of the left side of the skull.

PHYSIOLOGY. — **Okamoto** examined 1034 high school girls, and found that the percentage of inability to close the lids of only one eye was just the same as the boys, about 22 per cent. The percentage of the right inability was a little higher than that of the left. **Brunner** has investigated the auropalpebral reflex during narcosis; **Wodak** and **Falta** have written on the cochlear reflex and the method of eliciting it, and **Demetriades** on this reflex in the newborn. **Stoerk** believes the eyelid reflex is of pathognomonic value, and **Guillain** calls attention to contraction of the lids caused by voluntary occlusion of the eyes.

BELL'S PHENOMENON.—**Reitsch** maintains that Bell's symptom, as supplemented by the observations of Margulies in cases of absence of the phenomenon in hysterical paresis of the facial, is a consensual movement excited by innervation from the cerebrum; and that it can only occur when the function of voluntarily closing the eyes is completely intact. The symptom has been regarded as a measure of protection for the eyeball itself; thus Wilbrand and Saenger write that the movement of the globe upwards upon strong closure of the lids, is extremely beneficial for the protection of the cornea, iris and lens beneath the defense of the depressed eyebrow, etc. Reitsch disbelieves in any such protective action of the phenomenon in question.

Smoira reviews in detail the literature relating to Bell's phenomenon. Bell regarded it as physiologic. Later others came to regard it as pathognomonic of peripheral facial paralysis, in which it is particularly marked. It has been held by some a manifestation of the synergy of the elevator of the eye with the orbicularis palpebrarum, by others as reflex in nature. Frequently the opposite of Bell's phenomenon is observed, a downward movement of the eyes in the attempt at closing the lids. The author argues against the reflex theory on the ground that the movement is an unconscious one, and that it is just in peripheral facial paralysis where pressure on the eyeball is lessened. The eye movement is, according to Weiss, produced by relaxation of the eye muscles in closure of the lids. Smoira believes that the phenomenon must be explained by synergy on one hand, and by relaxation of the eye muscles in closure of the lids on the other.

PARALYSIS OF ORBICULARIS.—Temporary artificial paralysis by injection of novocain was found by **Blatt** to be the best measure to avoid voluntary closing of the eyelids during operation. (See v. 16, p. 146.) The same method was found to produce excellent results in the treatment of *blepharospasm* when other methods failed. Whether it can be completely cured by novocain injections depends upon whether the orbicularis contraction results from functional disturbance or organic lesion. The latter may be divided into 2 groups: where the lesion is central and where it is peripheral. Novocain may be injected once every day without the slightest danger. The lids remain open after fifteen minutes, the effect lasting one and one-half hours. The author uses 1 cc. of a 2 per cent solution with adrenalin. The puncture is made 1 cm. behind the point where the vertical tangent of the lateral orbital rim is intersected by the horizontal tangent of the lower orbital rim. The needle is thrust to the bone and then pushed vertically along the lateral rim. In withdrawing the needle 0.5 cc. of the solution is injected, then the needle is carried along the horizontal rim and 0.5 cc. is deposited in the horizontal. The solution should be injected into the muscle itself and not subcutaneously.

The pseudo Graefe symptom is the subject of a paper by **Krabbe**; and involvement of the superior facial nerve in hemiplegia with corneal reflex has been discussed by **Redlich.**

HEREDITARY PTOSIS.—The family upon which **Dimitry** reports included 38 individuals in five generations. In 21 cases there was blepharophimosis with ptosis. The descent was direct thru both males and females. The narrowing of the palpebral fissure was really the most important portion of the anomaly, and the usual operations for ptosis would not have been satisfactory.

Chance's case of congenital ptosis was complicated by an inability to look upward; all such efforts brought about sharp convergence of the axes, altho involuntary convergence could not be attained until the fixing object was carried upward.

Squarti reports two cases of congenital ptosis. The defect involved mainly the upper lids, motion of the eyeball being only partly impaired. The author believes there is some congenital defects of motility in the areas supplied by other cranial nerves, and the condition is to be classified among those resulting from defects in development of the respective nuclei. These defects consist in a failure of development brought about by factors which exert their influence upon the development of the nervous system before, during and after birth, for it is now accepted that the development of the nervous system, especially of the cranial nuclei, is only completed at about the fifth year of age. Neuropathic heredity, congenital syphilis, grave infections of the mother during pregnancy, toxic infections during early life, are recognized as causes. Galvanism, galvanofaradism, and local massage may yield some results; other methods of treatment, such as transplantation of part of the orbicularis palpebrarum, of the frontooccipital, or of the superior rectus, have not been attended with any success.

Heed reported the case of a boy, aged 3, affected with congenital ptosis of the left eye, on whom he performed a Motais operation in 1921. Three days after the boy's discharge from the hospital, the suture supporting the lid cut thru and the tongue of the superior rectus slipped back from the lid. He then performed a Hess operation, and 23 days after the operation the lid presented a natural appearance free from irritation. An abscess developed along the course of the external suture, but after treatment there was prompt subsidence of the reaction, followed by perfect movement of the lid with natural crease. He thought infection might be prevented by painting the sutures with iodin.

PTOSIS, CLINICAL.—**Comberg** observes that clinically ptosis includes all conditions of inadequate elevation of the lid. These may be distinguished as ptosis from a failure of power of the elevator itself—"primary ptosis"—and such as result from pathologic changes in the lid, "secondary ptosis"; the latter are discussed in the present paper. In recent inflammatory infections of the lid, the abnormal position of the margin of the upper lid is to be ascribed principally to diminished compressibility of the palpebral tissues. A varying effect must also be attributed to the modifications in the elasticity of the swollen tissue fibers, in consequence of increased resistance to folding. The influence of gravitation is, in general, without any effect upon the ptosis. In chronic inflammation, the ptosis may in some cases be due to increased volume, but in general, it is the permanent loss of elasticity which offers an increased resistance to the normal lifting of the lid.

Lehrfeld reported bilateral ptosis in a woman, aged 14, colored, who for 3 years had noticed drooping of the lids, becoming so extensive as to obstruct vision. Examination showed that there was not a complete paralysis of the levators, as there was a distinct elevation on superduction. The other extraocular muscles were normal and pupil reactions prompt. A Tansley-Hunt operation was performed, in which a tongue of skin was drawn thru a subcutaneous tunnel under the eyebrow and anchored by deep sutures to and beneath the skin of the forehead. As there was partial ptosis of the left, the suspending lip of skin was not cut very short. The sutures were removed in 10 days. When all swelling had subsided, there was elevation parallel with the left lid, which has since become stationary in its ptosis and apparently follows the right lid.

TREATMENT OF PTOSIS.—Based upon the experimental and clinical studies of Gallie and LeMesurier upon the applicability of transplanting and keeping alive fascia, aponeurosis or tendon, **Wright** has employed for the treatment of ptosis, sutures of fascia lata. A longitudinal incision is made over the outer side of the thigh 5 inches in length; the fascia lata is exposed and cleaned; two parallel incisions are then made in the fascia, 4 to 5 mm. apart; a piece of fascia between these incisions is then freed from the underlying muscle. Before cutting free this strip at its extremities, it should be split longitudinally into the two required sutures, as this is more easily done *in situ* than after removal. The fascia lata should be carefully closed with catgut before closing the thigh wound. The sutures are threaded on to fairly large, slightly curved needles with large eyes, and tied to the needles with fine strong silk to prevent their slipping. Wright, in conjunction with Hill, has operated upon eight lids, in five patients with congenital ptosis, with very satisfactory results. He believes this method of treating ptosis to be at least as good as any other. **Aranguez** divides the treatment of blepharoptosis into non-operative and operative methods. The former consists of rubbing the forehead with tinctur of strychnin (nux vomica?), electric treatment of the upper lid and the wearing of appliances to raise the lid. Operative procedures consist of (1) methods for shortening the upper lid, (2) methods for raising the upper lid, (3) a combination of both. They are all faulty from the fact that they convert a permanently closed eye into a permanently open one. The Motais operation gives good cosmetic and functional results, but is too difficult for general use. Aranguez's method is to isolate and divide the levator and suture it to the superior rectus, thus preventing the weakening of the latter which follows its division into two parts. The technic of the operation is described.

Esser describes in detail his technic of frontalis muscle plastic in ptosis, by which the lower end of the frontalis muscle is mobilized and brought to the upper eyelid, while the upper portion of the frontalis remains untouched.

Jocqs reports the end results of three cases of ptosis operated by him 27, 23 and 20 years previously. The first case had been treated by the procedure of Gillet de Grandmont, which consists in removing a portion of the tarsus; the effect being insufficient, de Wecker's operation of employing the frontalis was resorted to two weeks later. The immediate result was that in repose the upper lid covered about the upper third of the cornea; upon moderate contraction of the frontalis, the lid could be raised as high as that of the other eye. Upon examination 27 years later, the condition had remained unchanged; in fact the lid of the operated side could be lifted higher than that of the other.

The second case was caused by a gunshot wound in the right temple, leaving the upper lid in complete ptosis. The same operation was performed as in the preceding case with almost identical result, which remained unchanged when examined 23 years after operation. The third case, also the result of an injury, was operated by Motais' method; and 20 years later the lid had fallen considerably.

These three cases have suggested to the reporter the following conclusions:

In complete paralytic ptosis, the assistance of the frontalis must be obtained. Where the ptosis is incomplete, advancement of the tendon of the elevator may suffice, but this operation must be frequently supplemented by resection of the tarsus. As to Motais' operation, this method is manifestly contraindicated where the ptosis is complete; even in incomplete ptosis there is always the possibility of relaxation of the tongue of muscular tissue in time.

Bruns, referring to the three cases of Jocqs cited above, reports a case of his own, upon which he performed a very successful Motais operation for quite complete congenital ptosis. Twelve years later the condition of the eye was exactly the same as immediately after the operation. The eye can be closed entirely, and when no special effort is made, a palpebral opening 1/6 of an inch remains, and this is the condition when the patient is asleep. A photographic reproduction shows the upper lid almost as completely lifted as that of the other eye. In this case there was evidently no stretching of the musculotendinous tongue after an interval of 12 years.

Greeves performed a successful Motais operation for congenital ptosis. He remarked on the successful closure of the eye during sleep, despite the fact that the innervation of the muscle pulling the eye upward was the same as for that which pulled the lid upwards, the orbicularis obviously overcoming the action of the other.

O'Connor gives the results of six Motais operations, which he considers the operation of choice, giving the closest approach to the normal associated action of the superior rectus and lid elevator.

Rea reports a case of ptosis operated by Poulard's method. He chose this method in preference to a Motais, because every step of the operation is plainly visible, making it possible to gauge exactly how great an effect in opening the eye is desired. In the discussion, Collins observed that he preferred the Motais to the Poulard operation. Rea's patient could not completely close his eye so that it was probably open during sleep; but with a Motais complete closure was insured during sleep.

Radical operation for ptosis is the subject of a paper by **Zerolo**. **Allport** and **Claiborne** have written on resection of the tarsus.

BLEPHAROSPASM.—**Van Lint** observes that true blepharospasm is a rebellious affection. There is only a single certain method of cure (at least for a time): injection of alcohol into the facial nerve at the styloid process, but the resulting paralysis may be worse than the disease. He has accordingly attempted to localize the paralyzing effect of the injections to the orbicular muscle, by making the injection at the inferoexternal margin of the orbit, after preliminary injection of novocain. The result was entirely satisfactory in one case, but is evidently insufficient for drawing general conclusions. (See p. 29.)

MEIBOMIAN GLANDS.—**Klee** has written on the development of these glands and the lid margin. **Gifford** has studied the bacterial content of the meibomian glands in chronic inflammation and in normal lids. In 20 cases, 17 of simple meibomitis and 3 with hypertrophy, bacillus xerosis was found in smear or culture 9 times, a staphylococcus 15 times. In 5 cases of meibomitis with chalazia, B. xerosis was found twice, a staphylococcus 4 times. Some of the above growths in culture, no doubt, originated in the roots of the lashes, where staphylococci are almost always present. Organisms found in the smears are of greater importance than those found in cultures only; and in most of the smears where organisms were found, B. xerosis was present in much larger number than staphylococci, and was more often the only organism. Of other organisms, leptothrix was found twice, pneumococcus once, and bacilli identical with the Morax-Axenfeld twice. In the form with chalazia, pneumococcus was found once and a fusiform bacillus once. 20 normal lids of young subjects were examined for control. In these B. xerosis was found three times, a staphylococcus 15 times. In 20 lids of older men B. xerosis was found 14 times and staphylococcus 17. Certain other occasional inhabitants of the gland were also isolated.

Cowper states that three distinct types of altered secretion occur from meibomian glands; (1) A dirty white substance of a consistency similar to or somewhat thicker than that of cream cheese. This often exudes in the form of long very thin threads, or as comparatively large masses, probably depending upon the size of the duct opening. (2) An oily fluid, clear or somewhat turbid, and yellowish in color, which is expressed in an amount far exceeding normal. (3) A fluid resembling thin pus in color and consistency, no doubt a combination of 1 and 2.

The meibomian are large sebaceous glands. "Meibomian Seborrhea" seems an approprite name for the condition of altered secretion of these tarsal glands. The condition rarely produces symptoms. The writer believes that there are at least three pathologic conditions with which altered secretion of the tarsal glands has a definite relationship, exclusive of a case of his own which is probably unique. 1. Localized thickening and congestion of the tarsal conjunctiva, usually the outer or inner third of the lower lid; the symptoms are those of chronic conjunctivitis. 2. A chronic conjunctivitis especially of the lower lid, and causing a thickening of the whole lid, a wide intermarginal space and a rounding of the lid margin. 3. Chalazion.

The usual treatment consists in thoro expression of the glands, between the thumb nail of one hand and a finger nail of the other. The author describes a personal case, the outstanding feature of which was a peculiar substance moving up and down over the cornea with the lid movement; the tarsal glands are the source of this material. Treatment gave but temporary relief. Direct smears and cultural results showed B. xerosis to be present. The writer concludes that many lids show altered, usually sterile, meibomian secretion, the cause of which is not known. Abnormal lid conditions probably arise from these changed secretions. The treatment is not entirely satisfactory. Further microscopic bacteriologic and possibly chemical study is needed.

MARGINAL BLEPHARITIS. — **Patterson** reports on the treatment of ulcerous blepharitis with mercurochrome, altho he insists on the correction of any error of refraction or general disorder such as constipation, anemia, etc. The local treatment consists in removing the scabs with white ointment and hot boric acid compresses, thoro cleansing and epilation of cilia. Then a 5% solution of mercurochrome is painted along the lid margins once a day. A few applications result in a cure of the condition.

FAVUS.—**Franckel** and **Offret** remark that isolated instances of favus of hairless parts being rather rare, they report a case of the disease upon the lids in a lad aged 15. Three groups of typical favus eruption of the scutiform or nummular variety were seated upon the upper lid, one quite close to the external canthus. About these groups was found an oval zone, closely resembling parasitic circinate herpes. An eruption closely resembling trichophytosis was present on the chin and would have been diagnosed as such, had the palpebral lesions not been present. The hairs and the finger nails seemed healthy. There was a slight pre- and retroauricular adenitis. Rapid cure was obtained by 3% ichthyol ointment followed by alcoholic solution of iodin.

CYSTS.—**Mayou** reports a cyst of Moll's gland of unusual size existing for twelve years in a woman aged 66 years. It is situated on the lower lid margin at the inner canthus. It is translucent and obviously contains clear fluid. **Ellett** showed sections of a cyst of the upper lid.

D'Ombrain observed in a girl of 10 a swelling under the upper lid near the inner angle, of a week's duration; purulent conjunctivitis was also present. The swelling may have been an infected cyst.

Neame observed what he thought might be a cyst of Krause's gland in the lower fornix. He was somewhat uncertain of the diagnosis, as these glands are not so common in the lower fornix as in the upper.

PAROXYSMAL HYPEREMIA OF LIDS. — **Weekers** and **Halkin** wish to establish a new clinical entity; recurring paroxysmal hyperemia of the lids—a condition which has not yet found a place in the nosology of palpebral affections. They base their conclusions upon a case recently observed, arguing that cases of the same kind, and probably of the same nature, have been described under different names: blepharoptosis, blepharochalazion, dermatolysis, etc. This disease, in common with other diseases of the lids, terminates finally in palpebral atrophy leading to ptosis; but this is a secondary symptom and should not be permitted to mask the initial lesion which provokes it.

The principal histologic changes observed are: 1st, vascular proliferation, which showed itself particularly in the subcutaneous, muscular and pretarsal tissues with absence of inflammatory reaction; 2nd, dilatation with moderate inflammatory reaction of the small vessels of the derma, but especially a localized edematous dislocation of the dermic tissue and dilatation of the lymphatic spaces; 3rd, almost complete disappearance of the elastic fibers; 4th, thinning of the epidermis. Recurring paroxysmal hyperemia of the lid is a disease of childhood, as is true also of the similar cases described in literature under the name of blepharochalasis, etc. Occasionally an hereditary influence has been found. Clinical observations emphasize a neuropathic state of the subjects affected. In the case reported in detail, the Wassermann test was negative, but in a second case at present under observation, unrecognized syphilis was present; suitable treatment has resulted in rapid improvement.

WARTS.—**Campbell** uses electrolysis in the treatment of moles, warts, etc., and repeats it as often as necessary to end the growth. Four or five milliamperes are used for about ten seconds without an anesthetic. Generally one application is sufficient. The resulting scab should not be irritated, but should be allowed to come off gradually.

BLEPHARITIS.—Attention is called by **Matta** to cases of blepharitis that are especially persistent and severe, depend on the Morax-Axenfeld bacillus and do not respond to routine treatment applied to the lids. Smears show the bacillus abundant on the mucous membrane of the nose and nasopharynx. The patients are usually weak, anemic and scrofulous. They improve on applying active treatment to the nose and throat condition together with local treatment of the lids. Tonsillectomy has also been beneficial. The local application relied on is solution of zinc sulphat. **Yano** reports lichenoid dermatitis in both eyelids.

TARSITIS. — **Sobhy Bey** and **Tewfik** report a case of tarsitis following early Meibomian cyst. Chalazia were present, the tissue of the lower tarsus was excised from each eye showing most of the acini of the Meibomian glands normal, while some were inflamed, hyperplastic and showed cellular infiltration.

SCABIES. — In the case of **Eckmann** and **Konings** there was general scabby irritation of almost the entire body. The bulbar conjunctiva was a vivid red, with little yellowish points, the size of pin heads, irregularly scattered over it; each one contained a parasite. The same yellowish points were present on the palpebral conjunctiva. The cul-de-sacs were thickened but showed no yellow spots; secretion not very abundant. Pupils contracted, iris hyperemic; incessant itching, worse at night preventing sleep. Cure in three days from bathing the parts with hot sublimat 1 to 4000 and applications of a pomade of calomel, 1 to 5%.

MOLLUSCUM CONTAGIOSUM.—The histology of molluscum contagiosum of the eyelids is described minutely by **Poyales** and illustrated by a number of microphotographs. The typical structure is due to a degenerative process. Polygonal cells of the epithelium contain irregular perinuclear masses, which enlarge until the cell membrane ruptures, and the expelled matter constitutes the corpuscle. The theories of Kaposi, Leloir and others do not explain the infectious nature of the tumors of molluscum, nor the degenerative process by which they originate. Matter expressed was autoinoculable to some degree when rubbed into the unwashed skin of the mouth and arms. **Castroviejo** and **Munoz Urra** also take up the subject of molluscum contagiosum in an article well illustrated. In connection with the recent paper of Gifford and Gifford on molluscum conjunctivitis (p. 145), **Elschnig** points out that in 1897 and 1908 he showed that molluscum of the lid margin causes conjunctivitis.

ANTHRAX. — In **Knapp's** case a pimple of the lower eyelid was rapidly followed by great swelling of the lids, fever and prostrations. As there was discharge from the nose, frontal sinuitis was diagnosed and an operation attempted by a rhinologist. Upon incision the subcutaneous tissue was found unusually dry; the operation was stopped and culture showed anthrax. Antitoxin was given intravenously and locally about the swollen lids. Two weeks later there was an area of gangrene involving both lids, united at the outer angle in the shape of a horseshoe. This became demarcated and sloughed away, with loss of the entire lower lid except for the line of eyelashes, which is directly adherent to the orbital margin. The upper lid is about half its normal size, and the skin at the external angle is a congested, thin, atrophic scar. The eye, except for chemosis of the conjunctiva, is normal.

In the discussion Wheeler thought it would be possible to correct the deformity by a graft from the right upper lid. A graft may be taken from the upper lid 50 mm. long and 20 mm. wide, and it is not necessary to allow for contraction as in the case with grafts taken from other locations. He suggested deferring the repair of the shortened upper lid in order to get the benefit of the exaggerated suspension afforded by the contracted upper lid, after adhesions are made between the lid margins. There being considerable depression connected with the deformity in this case, it is a suitable one for turning a pedunculated flap from the temple if preferred to the detached graft. Fridenberg suggested a Wolff graft, as there was less chance that the lid would be drawn out of position by subsequent contraction.

Casolino had treated two cases of malignant carbuncle. Diagnosis was confirmed by bacterial examination. As the case was exceptionally serious antianthrax serum was resorted to, and in one case 200 c. c. was injected in seven days, and in the other 120 c. c. in three days. Both patients were considered cured within a week. Local treatment was limited to compresses with salicylic acid in solution of 2:1000.

GANGRENE.—Two cases of gangrene of the lids in infants are reported by **Weinberg.** The condition was noted immediately after birth in both instances, the inner canthus being affected in one, the outer in the other. Local treatment was of no benefit. Diphtheria bacillus was found in both cases. In one case general diphtheria developed but not in the other. Three other cases from the literature are cited, all in infants noted soon after birth, later developing into gangrene, suggesting vaginal secretions of the mother as the source of infection. The cornea was involved in all the cases, in one a corneal ulcer. Death resulted in 2 of the 5 cases. Fatality is preventable by early and thoro serum treatment. Early bacteriologic examination is important. In cases of mixed cultures, the pathogenicity of the diphtheria bacillus must be tested by animal experiment.

In **Satanowsky's** case of gangrene of lids in the new born, diphtheria bacilli were found in the pus. A few cases are on record, but the lids were affected secondarily.

EDEMA OF THE LIDS.—**Weekers** and **Colman** report the case of a woman of 74 who had suffered from the condition for 9 years, attacks recurring several times each year and lasting ten to fifteen days. Each attack was preceded by vertigo lasting some hours, the swelling sometimes attacked the upper lid of the right eye, sometimes the left, rarely both at the same time. It extended from the nose to the cheek. Between the attacks the appearance of the face became normal. During the attack the color of the skin was normal, pressure with the finger produced deep pitting which quickly passed away. The eyeballs were quite normal, as was also the nose and the adjoining sinuses. The Bordet-Gengou reaction for syphilis was clearly positive. She was treated with injections of grey oil. In the next two months the attacks had grown very much lighter, and for six weeks she had been entirely free from them.

Rubio reports palpebral unilateral edema. The upper, lower or both lids may be affected. The swelling is hard and painless, the skin but little reddened. There may be chemosis and conjunctival hypermia. There is no photophobia and no lacrimation. The onset is insidious. The edema is increased by warm and diminished by cold applications. The cause is obscure, probably bacterial, but not inflammatory; it is not produced by disease of the sinuses. Cold applications and injections of streptostaphylococcic serobacterin give excellent results.

Shoemaker states that numerous observers have reported conjunctivitis and excessive lacrimation occurring in patients after removal of the thyroid glands, and also in myxedematous patients. The two cases he reports had these symptoms, and in addition swelling or edema of the eyelids. In the first patient the symptoms disappeared after endocrin treatment. The second patient was treated for hypothyroidism, the swelling of the lids quickly subsiding. It would seem advisable to keep hypoendocrinism in mind as a possible etiologic factor in these cases. In **Weidler's** case there was great swelling of the cheek, lips, and right upper and lower eyelid, some eczematous eruption about the outer canthus, with photophobia and lacrimation, redness and congestion of tarsal and bulbar conjunctiva, with small granular deposits at the corneoscleral margin. A culture from the nose revealed a pure growth of staphylococcus pyogenes albus. Under a vaccin, the swelling of the eyelids and active inflammatory symptoms subsided.

GENERAL FIBROMATOSIS.—**Guist** summarizes the involvement of the eye and surrounding structures in Recklinghausen's disease (general fibromatosis). Such involvement may occur in various forms: either as a uniform hypertrophy of the skin of the lid and face, in which dense strands or nodes are perceptible, or pediculated tumors may form, as in other regions, with circumscribed hypertrophy of the skin overlying the growths. The disease may also be accompanied by other malformations; congenital hydrophthalmos has been observed in a number of instances. The hypertrophic changes of the lids are almost invariably monolateral; the distribution of the pediculated tumors may occur anywhere upon the face and body. According to present opinion, the origin of such connective tissue proliferation and fibroma formation is the connective tissue of the nerves; the changes in the hair follicles, glands, etc., being secondary. The affection is benign and becomes serious only from the parts involved. Every organ may be affected, but with varying frequency; the lid and eyeball constitute a slight percentage only in the incidence.

The following case is reported: male, aged 45, family history negative, as also Wassermann. When 21 years of age, discrete wart like formations made their appearance upon the entire surface of the body; these formations slowly increased in size. He was unaware of the presence of any involvement of the lid, but states that nodules appeared upon the eyeballs six months ago. The occurrence of conjunctivitis brought him to the clinic, when the following conditions were noted upon the right eye: External appearance normal; upon eversion of the lower lid, three spots of enlargement were observed at its inner margin: one, the size of a pea, near the punctum; adjacent to it a second, with the third at the external canthus; all of a grayish red color, conjunctiva injected at the corresponding points. The posterior margin of the upper lid presented similar nodules. A wide sessile tumor, firm in consistence and of reddish gray color, the size of a pea, was situated upon the center of the tarsus. The eyeball showed two similar nodules near the limbus upon the inner side; two smaller tumors were also present upon the lower lid margin of the left eye. Microscopic examination showed the growths to be instances of "soft fibromata." Guist sums up his case as one of multiple fibromata of the skin, partial hypertrophy of the left half of the face without band formation; plus neurofibromata at the limbus of the right eye, and an affection of both conjunctivae.

Pomplum reports two cases of plexiform neuroma of the trigeminal nerves with elephantiasis of the eyelids, in one case associated with hydropthalmos. Hypertrophy of the lids without hydrophthalmos has been described only by a few authors. In Pomplum's cases, the disease was proven to be neurofibromatosis originating in the nerve sheaths, with proliferation, due to elephantiasis, of the conjunctiva under the skin of the forehead and upper eyelid.

XERODERMA PIGMENTOSUM.—In a case of xeroderma pigmentosum reported by **Wolff**, the eyes presented marked photophobia, blepharospasm and lacrimation, the eyelids much involved. The tissues of the lower lids were atrophic, slight ectropion and absence of lower lashes. External canthus obliterated, conjunctiva of the lids moderately injected and in the lower lid very thin, shrunken and scarred. Conjunctival sac below fornix very small. Around the limbus a dense network of markedly dilated superficial blood vessels, which extended as far as the cornea. In the right eye, beginning below the nasal side of the limbus, there was a patch of coarse tissue similar to an epibulbar tumor, which proliferated over the cornea; this was uneven and separated from the healthy cornea by a walled off margin. Ophthalmoscopic examination could not be carried out. The general appearance of the right eye was that of a corneal opacity following an acute phlyctenule, except that the maculae were more numerous, whiter and not translucent. Owing to the photophobia, visual acuity could not be tested. A small tumor like growth was removed under anesthesia, and microscopic examination revealed a small zone of uninvolved corneal epithelium, in which there was an irregular tissue mass, rich in cellular elements but poor in connective tissue. The cells varied in size, some of them in the form of rosettes. The final diagnosis rested between carcinoma and chronic hyperplasia.

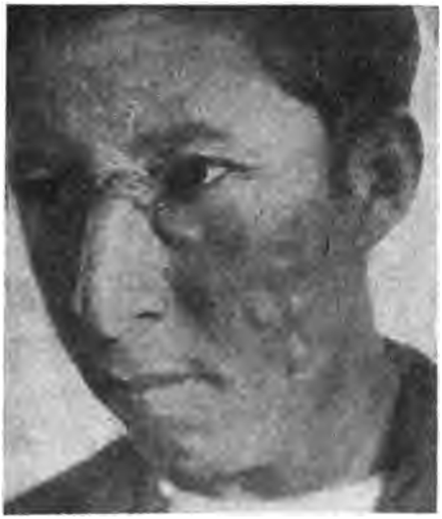

Fig. 13. Silva's case of sporotrichosis with lymphangitis, involving lids and lymphatics to submaxillary glands.

SPOROTRICHOSIS.—**Silva's** patient, a man of 27, suffered from an eczematous ulcer of the side of the nose, region of the lacrimal sac, upper and lower lids. From the latter lesions, a chain of gumma like swelling with lymphadenitis extended to the submaxillary glands. He had a negative Wassermann and positive von Pirquet. Cultures of material removed from the tumors gave characteristic mycelium and spores. The organism was also reproduced by inoculation in rats. Treatment with full doses of potassium iodid was followed by improvement and cure within three months.

SYPHILIS OF LIDS.—**Elewaut** observed ulceration upon the free border of the upper lid, 3 mm. in width, and a notch upon the free border of the lower lid, terminating in an ulcer of the conjunctiva; the ulcerations were of woody hardness; noninflammatory, indurated and moderate sized preauricular and submaxillary adenopathy was present. Bordet-Gengou reaction positive.

TUBERCULOSIS.—**Lundsgaard** reviews the Finsen treatment for the ocular complications of *lupus vulgaris,* of which the most important and typical are diseases of the lacrimal passages, keratitis and cicatricial ectropion. He observes that all plastic operations for ectropion in lupus offer great difficulties. Operation should be postponed so far as possible until the accompanying disease of the skin is cured; moreover, proper emplacement of the flaps is frequently difficult or impossible on account of the cicatrices present.

CHALAZION.—The chalazion forceps of **Blatt** is similar to the microscopic slide forceps. The lid is clamped between two rings which keep it bloodless and permit constant control of the tumor by the finger. It consists of one piece and is easily sterilized.

TRICHIASIS.—**Colin** observes that the usual operations for trichiasis complicating trachoma are unsatisfactory in that the results are not permanent. This is true of both Truc's operation "en vanne" and also of marginoplasty. Colin has combined the principles of both operations, with entirely satisfactory and permanent results. The operation is difficult, takes considerable time, necessitates rigorous asepsis and trained assistance; but the result is worth the trouble. The lashes are definitely turned away from the cornea to any desired extent and when the operation is properly performed, it is uniformly successful. Necrosis of the graft should never occur when the graft has been properly cut, sutured and bandaged. Five illustrations accompany the description of the operation.

Cragin describes a simple operation for trichiasis. Before operation with a local anesthetic, a crystal of copper sulphat is applied to the inner surface of both lids and to the pannus formation. Boric acid solution is used freely, and argyrol 10 per cent instilled daily. Two applications of copper may be used in one week. Then after general anesthesia with ether, an incision on the upper lid was made parallel to the margin of the lid, but one-third inch from the margin, from inner to outer canthus, penetrating the outer skin and extending thru the orbicularis palpebrarum, tarsus and finally conjunctiva and inner part of lid. This removed all the hair papillae with cilia attached. Six sutures are inserted in the margin of the lid, maintaining the skin and conjunctiva in apposition. The lower lid was incised the same way, and the vessels traversing the pannus were incised at right angles to their course and a small area of conjunctiva was curetted down to the underlying tissue completely around the pannus area. Bandage was applied for three days. Removal of the strip did not prevent complete closure of the lids, the only disability being loss of lashes which was corrected by wearing sun glasses.

ENTROPION.—**Halliday** operated with satisfactory results upon an infant of ten months with entropion, by means of Snellen's sutures. In another five months old child, he had done nothing but massage the lids. The mother reported that another little girl had had a similar condition as a baby but had recovered. In the discussion, Kelly thought the cases reported were of spasmodic entropion. Pockley considered the second case due to epicanthus. D'Ombrain had seen two or three cases in little children and a good result was obtained by pushing the lower lid in with the fingers. Another child wore spectacle frames without glasses; the contact of the lower edge of the rims kept the lid in proper position until recovery.

Hessberg reports the cases of a brother and sister affected with congenital entropion of the lower lids, bilateral in both. They were somewhat rachitic. The defect was remedied by Birch-Hirschfeld's operation for diminishing the effect of the central bundles of the orbicularis.

Clapp reports entropion following influenza, with a new surgical procedure for its correction. In a child of 27 months an attack of influenza was followed by a gradual turning in of the lashes, especially of the lower lids. The condition was not congenital. An operation was started on one eye with the intention of removing an elliptical piece of skin and the orbicularis fibers, but after making the incision 2 mm. from the external lid margin and removing the fibers with skin and subcutaneous tissue in a strip 8 mm. wide, it was found that after bringing the margins together there was still the same tendency to entropion, apparently due to the absence of orbital fat. The desired support was then supplied by fat transplantation from the abdominal wall. Healing was speedily accomplished. On account of absorption of orbital fat, the lids were again out of position and the operation was repeated. The method can only be applicable in a small number of cases, but gave good results in this instance.

In rebellious cicatricial entropion of the lower lid, **Baslini** has devised a technic based upon the procedure of Panas, which has given excellent results in three cases. As in Panas' operation, three incisions are made: A horizontal one thru the skin and orbicularis muscle 10 mm. from the margin of the cilia and involving the entire width of the lid. A vertical incision runs from each extremity of the one just made, terminating 2 mm. from the free border. He next makes an intramarginal incision along the entire length of the free border 2 mm. in depth, so as to separate the cutaneomuscular flap from the tarsoconjunctival one. The cutaneous flap marked out by these three incisions is dissected from below upwards for one-half of its height, well freed, drawn downwards and attached by two lateral sutures, so as to draw the cilia downwards in line, and carried two mm. beneath the free border of the lid. At the lower part of the large flap, a tongue of skin is cut out 2 mm. in length and directly attached to the cutaneous surface of the free margin; this small flap need not be sutured, but sutures should unite the three original cutaneous incisions.

After trial of all sorts of procedures for entropion of the upper lid, **Trantas** has adopted for the past six years the following method, of which the late results are as satisfactory as the immediate ones. Following ordinary local anesthesia, he incises upon the trichiasis plate the skin, and denudes the anterior surface of the tarsus as in Panas' method; the incision in the skin is made ½ mm. from the free margin and parallel to it, from the inner to the outer extremity of the lid; the denudation of the tarsus is 3 or 4 mm. higher, so as to circumscribe one-third or even one-half of that structure. These incisions are perpendicular to the tarsus and not oblique as in Snellen's method. The cutting edge of the knife should be outwards and not toward the conjunctiva. A vertical incision is then made near the temporal extremity into the band of tarsal tissue thus circumscribed, the piece is then raised slightly with a mouse toothed forceps to permit of its dissection by curved scissors, leaving the conjunctiva intact. The tarsal band is then entirely detached, leaving a wide trench open forward. Upon lifting the free border, it will be seen that the replacement of this is perfect. However, generally three sutures should be applied, the free ends of which pierce the margin near its anterior angle. The ends of the threads are tied over a pledget of gauze placed upon the free border of the lid. When the tarsus has been narrowed by atrophy, which is often the case, the tarsus is incised and dissected thru this incision and the conjunctiva freed as far as the cul-de-sac. A true advancement of the conjunctiva is obtained in this way, when upon placing the sutures, the free border of the lid will draw toward the upper border of the tarsus the conjunctiva thus freed. If the entire tarsus is very irregular and indurated, Trantas makes a total tarsectomy leaving the conjunctiva, thus avoiding the risk of provoking a keratitis by the sutures, which have to be placed upon the tarsal conjunctiva when total tarsectomy is performed from the conjunctival surface (Kuhnt, Straub). Two figures illustrate the method.

Birch-Hirschfeld observes that there are no lack of operative procedures for the correction of *ectropion and entropion.* In entropion the object is to bring the margin of the lid, especially the ciliary border, by traction into the proper position; in ectropion, to erect the lid by shortening or shifting the anterior surface. But how when both anomalies, inward and outward turning of the lower lid, are present at the same time? He reports such a case in an elderly subject. When the lids were opened there was decided ectropion of the lower lid showing 3/4 mm. of the palpebral connective tissue, with troublesome lacrimation. Upon closing the lid, its margin turned inward against the globe so that the lashes rubbed the cornea. This anomaly was evidently due to the fact that the fibers of the orbicularis were too relaxed to hold the tarsus in its normal position when the lids were open, whereas upon closure they became displaced toward the lid margin, pressing it against the globe when they contracted.

In this case the ordinary operations for ec- and entropion were evidently out of place. The object of the operation was to increase the action of the orbicularis as supporting muscle of the lower lid and to curtail its mobility against the tarsus, which produced the entropion. By an incision of the skin of the lower lid parallel to, and 3 mm. from, the border, the orbicularis was exposed and a bundle 3 mm. wide dissected. This was lifted by two sutures carried thru it, close to each other in the median line in such a fashion, that each suture passed thru it at two places; the fibers were then severed between the sutures. Both halves were drawn to each other by the sutures, so that the temporal portion was displaced to the nasal, and the nasal portion to the temporal side. Thru this shifting, the arc described by the orbicular fibers is shortened in the direction of the tendon, and the muscular plate in the middle of the lid enlarged on the anterior surface of the tarsus. The suture of the portion of the bundle drawn towards the nasal side was 1 cm. from the nasal lid angle immediately below the lid borders, with both ends carried thru and tied, and the one drawn toward the temporal side in similar fashion 1 cm. from the temporal lid angle thru the lower edge of the skin incision. Finally the wound was united by sutures. The cosmetic and functional effects in nine cases were excellent.

ECTROPION.—After a short review of the literature, **Wheeler** refers to a paper by himself (O. L. v 17 p. 394) in which he advocates in suitable cases of cicatricial ectropion, a detached graft of skin from the upper lid for ectropion of the lower lid, or ectropion of the fellow upper lid. In the present paper he describes the technic of the operation in detail, with 7 diagrams. He recommends this procedure, which is original with himself, as by far the best yet devised for cicatricial ectropion in cases in which it can be applied.

Holloway exhibited a patient on whom plastic operation had been done for cicatricial ectropion following an injury which had lacerated the upper and lower lids of the right eye. The first operation was done in March 1921, when the method suggested by Duverger was utilized with a most satisfactory result. A similar "halving" procedure has been described by Wheeler. In July a V-shaped operation was done at the internal canthus associated with a sliding flap taken from the side of the nose, to give additional tissue in case of cutting out of certain sutures. In November a very slight defect remained at the inner canthus, which was corrected with a final result; complete restoration of the lower lid and conjunctival cul-de-sac.

Story reports a case of ectropion of the upper lid of 6 or 7 years standing in a man, aged 21, caused by a fall which had torn the upper lid and injured the lower border of the orbit. A plastic operation had been done and a dense mass of cicatricial tissue excised. The lids were sutured together and a thick flap of skin and subcutaneous fat from the arm inserted into the cavity. So far as could be judged the results promised to be satisfactory.

Inflammatory ectropion of the lower lid was treated by **Sanchis Bayarri** by the procedure of Blanco; modified Snellen sutures, introduced on the conjunctival surface near the lid margin and carried down thru the tissues to be tied over a roll of gauze or plaster upon the cheek.

SYMBLEPHARON.—After operation for symblepharon, **Kuhnt** considers it essential to keep the transplanted epidermis or mucous membrane so closely and firmly pressed against the whole wound surface of the fornix, that any secretions or hemorrhages between both are excluded. This can not be achieved by pressure of prothesis or shells from above, but only by uniform traction from below. He attains this by inserting a "fixator" on the transplanted surface and fixing it by sutures on the uppermost part of the cheek. The fixator consists of an arc of pliable silver, hollow with flat upper margin, of a diameter of 3 mm. and 2 mm.; three pairs of holes (distance of holes 2 mm.), one in the middle and one on each side. Each hole is 1.50 mm. wide. A Thiersch flap, about 6 mm. long and wide is well spread, the fixator placed in the center, thru each pair of holes a double armed suture, is transferred to the wound. The needles pierce the fascia and periosteum of the orbital margin and are tied on the cheek over rubber drains, under moderate pressure. To avoid agglutination between bulbar and palpebral parts of the transplanted skin, a broad piece of protective covering with borated vaseline is fixed above the fixator by sutures penetrating the whole thickness of the lid. The fixator remains from ten to fourteen days.

TARSORRHAPHY.—**Dubois** believes that more attention should be paid to the operation of tarsorrhaphy which is described everywhere but seldom practiced. In examining the statistics of different clinics for the last 12 years, he found it mentioned a few times in Gröninger only. He has performed the operation nine times upon eight patients with satisfactory results. When there is a permanent diseased condition, the cause of which can not be removed, and the aperture can not be closed permanently, tarsorrhaphy serves very well. In lagophthalmos which can not be remedied, the shortening of the aperture between the lids, will lessen the uncovered portion; the lids will adapt themselves better to the globe so that the eye closes more perfectly: the operation is preventive. It will also influence favorably a chronic inflammation of the conjunctivae which are too much exposed to the air.

The two most important indications for this operation are paralytic ectropion from incurable facial paralysis, and the exophthalmos of Graves' disease. After the operation, patients with facial paralysis can close their eyes somewhat better, the paralytic ectropion disappears almost entirely; the aperture is much smaller, the tears less and the cosmetic result good. The "staring" in Graves' disease is much less. In the discussion Faber thought that prolapsis bulbi should be added to the indications for tarsorrhaphy. In a patient with Graves and high myopia who had developed prolapsis bulbi, he closed the aperture for about 1.5 cm. at the temporal side; in order to make the closure firm, he slit the upper and lower lids and sutured the separate parts together.

According to **Kuhnt**, real prospects of success can only be expected in *lagophthalmos* due to ectropion or traumatic defects. He obtained results with tarsorrhaphy after excision of a wedge shaped piece of the tarsal conjunctiva of the upper and lower lids according to Kuhnt-Szymanowski; they were, however, not lasting. He therefore devised a method which gives the lower lid a firmer support and keeps the upper lid in downward tension. He obtained this by healing in of silk sutures starting from the ligament of the internal canthus, anchored in the superficial layers of the tarsus of each lid and fixed in the periosteum of the temporal orbital wall.

BLEPHAROPLASTY.—**Cross** reports a series of 4 cases of plastic repair of the eyelids by means of pedunculated skin grafts, with illustrations showing the details of getting the grafts in each case. Among the prerequisites to success, he points out that sufficient time must elapse after primary repair to allow for shrinkage and contraction of the scars. In all cases involving the lacrimal area, the removal of the lacrimal sac is first to be undertaken. In planning the shape and position of the graft, much can be learned by experimenting with grafts cut from a gelatin faced cast. After extirpation of the lacrimal sac the edges of the lower lid and conjunctiva were freed from the scar. A model of the tissue required was cut from rubber, allowing a good margin for shrinkage. This was laid on the skin to map out the best area from which the grafts would be taken. When swung into place the graft was secured by suturing with silk, horsehair and silkworm gut. If the graft appeared cyanotic, it would be stabbed full of holes to drain out the venous blood. The mattress suture seemed to interfere less with the circulation and effectually prevented depressed scars. When the flap became infected, large hot compresses of normal salt solution night and day saved it. In taking a flap from the cheek, there must be care to avoid the whiskers and the salivary duct. Some of the cases required treatment by repeated operative steps.

Poulard, in small colobomas, makes a T-shaped incision, dissects up the flaps and unites them by sutures. In large colobomas, he makes a curvilinear incision of the lid as far as the free border, followed by autoplasty.

In cicatricial coloboma of the lids, **Duverger** makes an incision on each side of the cicatrix, as far as the brow, splits the lid and supplies two rows of sutures; the conjunctival cicatrix thus does not lie opposite the cutaneous cicatrix. This procedure is applicable where the free border is well preserved.

Smith, in reporting plastic repair of the lower lid, emphasized that he could see no advantage in burying the Thiersch covered stent mould as advised by Gillies, but thought it better to stitch the lower to the brow temporarily, thereby keeping the new area on the stretch. This does not apply to the Esser inlay, where burying is necessary.

Waldron traces step by step his plastic operation on the lids and orbit in an illustrated article of some length, and emphasizes that many failures result from operating at too early a date after initial injury and overanxiety in performing subsequent operations. Three months should elapse after a wound has healed before plastic operations are undertaken, and a similar time between operations. **Kaz** has described a single stage plastic operation of the upper lid including muscle fibers and lashes.

Goldthwaite describes his plastic repair of defect of the lids following removal of an epithelioma near the inner canthus. To avoid the ectropion which commonly follows such operations, he thinks it essential that sufficient tissue be introduced into the defect to fill it without tension on the tissue of the lid. **Minchew** reports transplantation of flap repair of lower lid after removal of epithelioma.

Nutting thinks that it is important in plastic surgery in and about the eyelids, that a photograph be taken before and after the operation to avoid undue criticism. He describes minutely the care that should be taken in accurate approximation of skin edges, even application of grafts, asepsis and a properly prepared field. The author prefers the Thiersch method on account of its simplicity.

Filatow describes his method of plastic operation, which is based upon a cylindrical pedicle for the nourishment of the graft: (1) Formation of the pedicle. A linear strip is marked out and dissected up from the neck by two parallel incisions, the extremities being left attached. The skin wound thus made is sutured, the edges of the superjacent dissected strip are sutured together thruout their entire length, thus forming a cylindrical pedicle united to the skin at both of its extremities.

(2) The operation. At the expiration of three weeks, the dissected parts (tumor, cicatrices) are removed; a flap of the desired size and form is constructed at the extremity of the pedicle, placed upon the wound surface

and united to the margins of the latter by sutures. (3) Conclusion of the operation. When the flap has united (10 to 15 days later) the nutritive pedicle is dissected off at its junction with the flap; excess of tissue, if present, is removed; the dissection wound of the flap is united by suture; the pedicle is either excised at its proximal extremity, or applied, if necessary, for additional grafts.

Following free dissection of the lower lid, **Schmidt** prepares a covering for the defect along its lower margin in the form of two pedunculated curved flaps, one from the outside and one from within, so that a firm connection between them remains. The defect is covered with the two flaps which are brought up, and now just meet in the middle because of the shortening of the tendon. The skin is drawn up from further down over the defect on both sides of the connecting bridge of tissue. It is fastened to the bridge and does not rest upon the upper pedunculated flap. Following this operation the skin is smooth, a feature not true of other operations.

Zentmayer described the Maxwell operation the skin is smooth, a feature both the upper and lower culdesac in a patient with a greatly contracted socket, and on whom several operations of different nature had previously been performed by another without success. He had found from previous experience that no especial care had to be taken of the elevator of the lid.

In an individual with numerous cutaneous cicatrices upon the forehead and cheeks, which prevented taking a flap, **Cramer** succeeded in restoring a lower lid and making prothesis possible by the following method: as a first step he made an incision parallel to the orbital margin 1 cm. from that margin; he united this incision to the palpebral angles by oblique incisions; the flap thus described was dissected as far as its junction with the orbital contents. *A flap of cartilage,* the size of the tarsus, was taken from the tragus; this cartilaginous flap was then slid under the cutaneous flap and sutured in place. Three weeks later, the two angles of the flap were freshened, the flap was limited to the extent of the cicatrix and drawn upwards. At both angles of the upper tarsal cartilage, the upper lid was deeply incised upwards, and the freshened angles of the lower cutaneous flap were drawn up and fixed into the pocket of the upper lid on both sides by a wire suture. To fill the loss caused by the displacement upwards of the cutaneous flap, a second cartilaginous flap was taken from the ear and finally a Thiersch flap from the thigh. Cicatrization was not satisfactory; both the Thiersch and the cartilaginous flap sloughed owing to a fistula communicating with the maxillary sinus, which had not been cauterized; this was successfully combatted by excision of the slough and an ointment of pellidol. The lower lid was sufficient to permit prothesis. Cramer thinks that this procedure deserves trial in other cases. **Remky** excises a piece of the helix in the shape of a trough, the skin at the posterior surface of the ear remaining intact. After intermarginal section, the conjunctiva is undermined from the lid border and shifted backwards and the cicatricial tissue excised, preparing a sufficient pocket for the cartilage flap; this is inserted and fixed by sutures thru the lid, which are tied on the outside over a piece of gauze. The skin of the flap is carefully united with the face lid border and the conjunctiva; the threads may be removed after five days. Thus a permanent trough is created for the lower margin of the prothesis and the lid is given a solid support. The method gave excellent results.

The use of ear cartilage to stiffen the upper lid after loss of the tarsus is reported by **Löwenstein**, who includes notes of a case, in which the patient had suffered from trachoma for which the tarsus had been removed. **Blaskovics** reports free transplantation of a portion of the tarsus from the upper lid into a lower lid formed by blepharoplasty.

Parker reports 8 cases of blepharoplasty, one of senile ectropion, for which excision of a triangular portion of the lower lid below the outer canthus was done; one of cicatricial ectropion following the bite of a horse, for which a flap was taken from the inner side of the arm. One case resulted from dynamite explosion in the coal mines, causing cicatricial ectropion. In addition to the thin flaps, a whole skin graft was used for one lower lid. One case of cicatricial contraction of the lids, causing complete eversion, was due to a gasolin burn; and one to a paste applied for supposed cancer. He believes it generally better to apply dressings to thin skin grafts, unless the surface is smooth. Narrow strips of gutta percha tissue, slightly overlapping, may be placed over the grafts and gauze and bandages applied over these. All scar tissue should be removed from the area to be covered and all bleeding stopped. The use of vaselin facilitates cutting the graft and prevents it from rolling up. In one case the entire lower lid had to be replaced after removal of an adenocarcinoma, and in one the tissues removed for epithelioma. To restore the orbit in a case of microphthalmos, the external commissure was divided at the orbital margin. A mold was made of dental modelling material and covered completely with two thin grafts taken from inside the arm. In such an operation it is important to cut the lid thin; the tarsus may be ignored, but all scar tissue must be removed.

Oliver and **Jackson** gave a remarkable demonstration of facial improvement, brought about by their imitation of the appearance of the normal eye on the spectacle frame, of those who, during the war, had received wounds of the orbit resulting in evisceration.

In a case of destruction of the eye by a gunshot, which also carried away the lower lid, **Oliver**, in order to prepare the orbit for an artificial eye, emphasizes the importance of lining the flap of the graft. **Francis** reports two cases of epidermal graft of the lid.

The Orbit

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This section of the digest carries the literature from August, 1921 to August, 1922. For previous references see O. L. 1921, v. 17, p. 396.

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DIGEST OF THE LITERATURE.

ANATOMY, BONY ORBIT.—**Cameron**, in an article on the contour of the orbital aperture in representatives of modern and fossil Hominidae, states that the generalized form of orbital aperture in the adult male skull of modern races is represented by a quadrangular contour, individual variations of outline depending upon the degree of "rounding" of the four "angles." Moreover, if the orbital aperture be enclosed with a rectangular figure with horizontal and vertical sides, it will be found that the four "angles" of the quadrangular orbital contour are in contact with the sides of this rectangle at fairly well defined points. The surface areas of the "unoccupied spaces" between the orbital contour and the angles of this rectangular figure will be found capable of some degree of comparison in different crania. The main factors in the production of the quadrangular form of orbital aperture are as follows: 1. Influence of the developing frontal and maxillary air sinuses; 2, resistance exerted by the perivascular fascia of neighboring bloodvessels and nerves; 3, traction exerted by muscles; 4, growth and expansion of the brain.

Marx has studied the relation of the form of the skull and orbits. He finds that in scaphocephaly the orbits are somewhat broader than in normal skulls, but in oxycephaly about normal. In the latter, however, the entrance to the orbit is reduced in all directions and the orbit shorter than normal, as would be expected from deficient development of the frontal bone. He reports a case of oxycephaly with the cephalic index strongly bachycephalic.

ORBITAL CONTENTS.—**Parsons**, in prepared dissections of the orbit, called attention to the position of the globe in the upper part of the orbit, and to the S shape of the optic nerve in the orbit. He demonstrated that the lacrimal gland was not really divided into two parts, but deeply grooved by the levator palpebrae superioris tendon, which went right into the gland and made a deep groove in the anterior part, so that the division of the gland into two parts only occurred quite in the anterior portion. He also called attention to the rapid development of the orbit in early youth, and suggested that its growth could not be accounted for by the deepening of the nose as has been supposed, but that the growth of the orbit was the first change that occurred.

Sutton found that the entire orbital contents are surrounded by fascia. The eyeball has a fascia bulbi or Tenon's capsule; the muscles are covered and held together by muscle fascia. The fascia of the superior oblique is attached to the trochlea by means of fine folds of fascia, which run from the muscle fascia to both sides of the trochlea. The fascia of the muscle passes with the tendon of the muscle thru the trochlea. The part that covers the inner surface of the muscle communicates with the fascia bulbi, while the remainder passes to the orbital margin and fornix.

MEASUREMENTS. — **Jackson** believes that it is especially important that our knowledge of the relations of the apex of the orbit to the superficial landmarks that can be identified during life be more exactly determined. He has studied the position of the eyeball in the orbit, and the relations of the soft parts in and about the orbit to one another, and to the bony walls of the orbit. He considers first the usual relations of the eyeball to the walls of the orbit.

As a definite landmark, the outer margin of the orbit at a point opposite the outer canthus is chosen, as the most constant and most accessible part of the bony margin. The other margins vary on account of the underlying sinuses. The author uses a base line joining the most receding points of the orbital margins, and measures the relations of the various parts to it. His own measurements on a few skulls show the apex of the orbit to lie 28 mm to 30 mm. behind this base line. The width of the ethmoid in the skulls measured was approximately uniform 28 mm to 31 mm. He then deducts 17 mm. from one-half the base line to find a point closely in front of the optic foramen. The author measures from the crest of one orbital margin to the opposite crest, and gives his results on 4,650 patients from 5 to 85 years of age. The width of the base line increases during early life, but is about the same for boys and girls up to 17 years, when the base line of boys becomes wider than that of girls. The author found that there was a relation between these measurements and general bony measurements. Disease may disturb the measurements in childhood, but never in adults.

The first step in determining the relation of the eyeball to the base line is to measure the distance between the centers of the two corneas, which is the practical equivalent of the distance between the centers of rotations of the two eyes. Beginning at about 5 years, the average intercorneal distance for boys and girls is 52 mm., while the maximum for adult girls is 61.5 mm. and for adult boys 63.7 mm. This intercorneal distance in connection with the base line is the basis for determining the position of any part of the globe following the standard tables on dimensions of the globe. The location of the eye with reference to the outer bony margin is obtained by subtracting one-half the interpupillary distance from one-half the base line. This gives the location of the center of the cornea, or optic axis in the primary position.

The height of the eyes is more difficult to determine, because the vertical displacement of one eyeball will have to depend on our comparison of one eyeball with the other. The lower orbital margin is more constant, and in asymmetry the plane thru the lowest points of the two margins is best. Such comparisons are better than any measurements.

The proptometer suggested by the author and the exophthalmometer of Hertel are recommended as the best methods of measuring the projection of the cornea. At five years this measurement is 10 mm. for both boys and girls, and increases up to 14 mm. at 10 years. From then on, girls increase up to 16 mm. at fifteen years, and boys up to 17 mm. at 23 to 24 years. The two eyes may differ noticeably in prominence in about 20% of the cases (0.5 to 2 mm).

The general tendency of the eye to protrude on widely opening the lids, must be considered in making measurements. This is an actual moving forward of the eyeball varying from no protrusion in 3% of the cases to 1 mm. in 2.5% of the cases. In making measurements the lids should be equally separated over each eye. The author, in making measurements on 5,000 cases, finds that there is no change in position of the globe in relation to the bony orbit, with increase or decrease in body fat. The full eye of the fat man, or sunken eye of the emaciated patient, is only an apparent fullness or sinking. The connective tissue framework of the orbit, capsule of Tenon, check ligaments, etc, resemble in permanence the bony orbit. Actual displacement of the eyeball other than the physiologic protrusion on opening lids widely comes slowly, and as far as the author has observed, is not recovered from. The average eyeball is two-thirds in advance of the outer margin of the orbit, while some are entirely in front of the base line.

Whitnall's book on Anatomy of the Human Orbit and Accessory Sinuses has been reviewed in ophthalmic journals (A. J. O. v. 5, p. 325) and can only be favorably mentioned here.

ANOMALIES, MUSCLES.—**Whitnall** described an abnormality of the levator palpebrae superioris muscle, which showed the two variations commonly described, the tensor trochlea, and the transversus orbitis, and in addition an offshoot passing to the lacrimal gland. The origin of the musculus obliquus inferior was found to lie a quarter of an inch lateral to the normal site, in 14% of 100 orbits dissected; only 45% were found to be adjacent to or 1 mm. away from the opening of the nasolaryngeal canal. In addition he refers to abnormalities of the recti muscles mentioned by other authors.

ENCEPHALOCELE. — **Lunding-Smidt** and **Jensen** report a case of posterior orbital encephalocele in a two day old baby; in which, when the eye was enucleated on the seventh day because of sloughing of the cornea from exposure, there was found a fluctuating tumor in the orbit from which on puncture there escaped a seroviscous fluid. The orbit was packed without further interference. Two months later, the encephalocele had reformed, but was still covered by the lids. The authors define encephalocele and give an outline of its subdivisions, pathogenesis, symptomatology, differential diagnosis, prognosis and treatment.

The prognosis they say, is uniformly poor and treatment uniformly unsuccessful. They seem to think radical operation should be undertaken as offering the only possible hope of a cure.

LEONTIASIS OSSEI.—**Suker** described the conditions presented in two men, in the sixties, showing changes of leontiasis in the cranial bones, involving the orbits, and implicating the optic nerves, producing a choked disc with secondary atrophy in three eyes. In both cases a divergent strabismus resulted from the encroachment in the orbit by spongy bone along the inner walls, characteristic of leontiasis. In addition there was a pronounced proptosis of the two eyes. Upon radical removal of this spongy bone, the eyeballs receded, the divergence practically disappeared and also the choked disc, but necessarily not the atrophy. Roentgenograms of other parts of the skeleton showed but a moderate leontiasis of one tibia and fibula in each patient. One patient was still living; the other died because of the excessive process involving the sphenoid in the region of the sella.

CAUSES OF EXOPHTHALMOS.—**Howley** gives as the cause of monocular exophthalmos tumors of the orbit, abscess in the ethmoid, sphenoid, frontal sinus or antrum, paralysis or tenotomy of the ocular muscles, thrombosis of ophthalmic vein or brain tumor. The author describes 5 cases illustrating these different etiologic factors.

Caillaud reports double *posttraumatic* nonpulsating exophthalmos in a patient who fell striking his head. Exophthalmos appeared on the right side 5 days later, and on the left two days after that. The condition increased steadily for two weeks, accompanied by papillary stasis; it then gradually decreased and disappeared in about 6 weeks. The papillary stasis also increased and then decreased in severity. The only remaining vestige was a grayish appearance of the papillas. The author thinks the exophthalmos due to an *arrest of the venous circulation.*

Warlow reports a case of a woman 48 years old who had marked exophthalmos of both eyes resulting from purulent *disease of ethmoid* and sphenoid cells.

A woman 65 years of age complaining of protrusion of the right eye for about seven months was observed by **Hird** which may have been due to *trauma.* There had been a swelling over the right parotid for thirty years, following a blow. The facts of his case are as follows: Right vision was 6/24, and not improved with glasses. The left vision was 6/9. There had been an ulcer on the lower part of the right cornea. The right eye was proptosed directly forward 10 mm. beyond the other eye. There was only slight limitation of movement laterally. X-ray photograph showed nothing pathologic in the orbit or accessory sinuses. Nasal examination negative; Wassermann test negative, urine normal. The peripheral fields were full, but there was a slight vertical enlargement of the right blind spot and no central scotoma. The right optic disc was a little indistinct and pale. The ophthalmic division of the fifth nerve was not impaired.

Heeb and **van de Erve** report two cases of exophthalmos. In the first case, a girl of 17, the condition was due to pressure from the brain; in the second, a girl of 7, operation revealed a cyst intimately attached to the optic nerve, and the two could not be separated. The nerve was sectioned and the growth removed. Examination of the specimen led to the belief that it was the result of a *hemorrhage* into the the optic nerve with cystic degeneration.

INTERMITTENT EXOPHTHALMOS. — **Lindenmeyer** considers this probably due to a varicose *enlargement of orbital veins,* which is produced by an obstacle in the outflow of the orbital venous blood. This supposition is based only upon hypothesis, as the necropsy in one of Lindenmeyer's cases did not afford the opportunity of clearly ascertaining this. The possibility of a necropsy must not be counted upon, as intermittent exophthalmos is a very rare disease. We are justified in enriching the literature by publication of new cases. Lindenmeyer's case presented the following features: the exophthalmos of the left eye appeared not only when patient stooped, but also by compression of the left jugular, and was more marked when the right jugular was submitted to compression. The exophthalmos was more prominent when the head was rotated toward the right side; in that position the left jugular is not hampered in its outflow. The cause must lie in the outflow of the left orbital veins, and chiefly of the left jugular. As Krauss and others found in some cases that the right jugular is wider than the left, the exophthalmos should be more frequent on the left side. As a matter of fact, in 13 cases of the literature Lindenmeyer found 11 of left sided exophthalmos. A disposition of the vessel's walls to varicose enlargement complicates this faulty development of the jugular veins.

Byers reported a case of intermittent exophthalmos in a young woman, 21 years of age, which seemed to be influenced by the *pressure of a cervical rib.* The right eye, which normally showed a position of relative enophthalmos, could be made to advance its position in the orbit 10 mm. by pressure being exerted on the right internal jugular vein. It also came forward following stooping, turning the head to the left, or to the right, throwing the head well back, and on holding the breath after forced expiration. His studies led him to conclude that it was associated with a varicose condition of the orbital vein of supposedly congenital origin; that it followed pressure on the internal jugular by the surrounding parts, altered in their relationship by changes in the position of the body.

Steele found that a child, twelve months old, suffering from *scurvy,* had "off and on protrusion of the right eye." The left eye was in normal position. Under proper feeding the general condition was cured and the eye returned to proper position.

Zirm observed, in an entirely healthy five year old child, an *edema* of the lids appearing eight times within three months without demonstrable cause and without any other disturbance of the general system. This edema was usually combined with exophthalmos, lasted each time five or six days and then disappeared spontaneously. He conceives of the exophthalmos as an expression of intraorbital edema, and is inclined to attribute the entire symptom complex to *angioneurotic edema.*

PULSATING EXOPHTHALMOS.—**Behan** reports a case of pulsating exophthalmos in a man 27 years of age. The origin of the exophthalmos was obscure. The vision of the left eye was found to be poor two years previous to the author's examination, lately followed by discoloration of the skin of the left lower lid and a gradual swelling of the eye. Headache and intermittent hissing sounds had first been experienced the day previous to the examination. Vision of the right eye was 20/20; of the left eye, ability to count fingers at four feet in the extreme temporal field.

The left eye was displaced forward 6 mm. and downward 2 mm. There was a subcutaneous mass about one inch in length and one-fourth of an inch wide, protruding downward and outward between the globe and the lower inner margin of the orbit. This mass pulsated synchronously with the radial artery and could easily be replaced within the orbit. Change in the position of the patient did not affect the size of the mass nor of the exophthalmos. Ocular movements were normal, with the exception of slight limitation of external rotation. The subconjunctival and deep scleral vessels were markedly distended and tortuous. Pupils, O. D. 3 mm., O. S. 4 mm., regular, reactions normal. The fundus of the right eye was normal. In the left eye the disc was slightly hyperemic, especially on the nasal half, the margins were indistinct but without swelling, the retinal vessels engorged and tortuous, but there were no hemorrhages.

There was no visible pulsation or tremor of the left eye. There was, however, a slight but distinct pulsation felt on pressing the eye directly back into the orbit. Objective bruit could be heard only anteriorly within the limits of the orbit. The patient heard a buzzing noise in the head more distinctly on the right side. Under observation the exophthalmos increased to 8 mm. and the subjective bruit had so increased as to prevent sleep. The internal jugular vein was prominent. The bruit could be stopped by compression of the left common carotid. Ligature of the internal carotid caused diminution of pulsation but not cessation. The common carotid was ligated in two places just below the bifurcation and the artery severed between the ligatures.

At the time of the ligation, there was a sudden divergence of the left eye almost to the limit of external rotation and immediate blanching of the subconjunctival vessels. The pulsation of the protruding mass and of the eyeball ceased. Immediate blanching of the disc and retina occurred, followed by a sudden restoration. The patient recovered from the anesthetic sufficiently within ten minutes to say that all noise in the head had stopped. Two and a half hours later the fullness beneath the eye had almost disappeared. There was some fullness of the conjunctival vessels, exophthalmos of 4 mm., slight numbness of right side of the face. The divergence had disappeared. Vision was restored in the left eye to 20/30. Recovery was satisfactory and the patient resumed his work as a truck driver. Four months later he rolled off a truck, became unconscious and died a few hours later. No autopsy was obtained. The medical examination gave the cause of death as cerebral hemorrhage.

In a case reported by **Riese**, injury was produced by a blow with a split stick, which pierced the upper border of the conjunctiva. Chemosis and abolition of vision followed in one day. After twelve days, there was pulsating exophthalmos with intense throbbing in the entire left half of the cranium and neck. After five weeks, the internal carotid was ligated in the neck. Throbbing immediately ceased and the audible humming gradually decreased. As vision was lost, the patient complained of ocular pain, and as there was still some exophthalmos and marked dilatation of the conjunctival veins, the eye was enucleated eight months after the injury.

As the cause of the exophthalmos was believed to be a tortuous ophthalmic vein behind the eyeball, enucleation was performed with special caution. Recovery was uneventful. The case was one of *injury to the internal carotid* within the sinus cavernosus and thus of arteriovenous aneurysm. Possibly a splinter entered the sinus thru the orbital fissure, as indicated by injury to the optic nerve, which Professor Collins found to be injured within the cranium, in front of the chiasm. Again, injury to the carotid and optic nerve may have been due to separation of the anterior clinoid process from the alar portion of the sphenoid. The author believes that ligature of the internal carotid is preferable in such cases to that of the common carotid. Statistics show that it is preferable and also that its results are permanent. Most relapses after ligation of the common carotid occur at the latest in one year; usually within four weeks. In this case cure has lasted for one year and eight months.

A case of *ligature of common carotid*, with fatal *damage to the brain*, is described. The patient was a youth of 18, with a fibroma of the nasopharynx which had invaded the pterygoid fossa, superior maxillary and antrum of Highmore. It was extirpated after ligature of the external carotid on both sides, with temporary resection of the right superior maxillary by von Langenbeck and Weber's method. Coma ensued in four hours, and death in forty-eight hours, with right hemiplegia. The left carotid had been first ligated, between the branching of the superior thyroid and lingual; the right carotid was then similarly treated. At autopsy the left carotid was found not divided as usual; it ascended to the base of the skull, instead, and gave off a few twigs. The surgical maxim generally holds good that the artery supplying branches to the jaw and neck is necessarily the external carotid. There are also rare cases where the common carotid ascends in the neck without giving off the external branch;

absence of the internal carotid is still more rare.

Riehm's patient was a 43 year old woman, who six months after an attack of *influenza,* commenced to have in the right eye redness, pain, exophthalmos, loss of vision, followed by the development of enlarged bloodvessels on the face and head. Six months later, examination showed bilateral exophthalmos, more marked and pulsating on the right, right abducens paralysis, choked disc, more marked on the right, enlarged veins on the eyelids and in a wedge shaped edematous spot in the middle of the forehead, and a systolic bruit, audible over the head, controlled by compression of the carotids. Physical examination practically negative, except for a left inguinal hernia. In a few days, the exophthalmos and choked disc on the left increased and a left abducens paralysis appeared. The patient was otherwise well and able to continue at work. Apparently no treatment was instituted.

About five months later she was admitted to the hospital because of pain in the inguinal hernia. Operation revealed miliary tubercles in the hernia sac. The patient died 12 days later. Autopsy revealed on each side of the sella turcica, surrounding the hypophysis, a blood filled dural sac each communicating with the other, with the petrosal sinus and with the internal carotid. The posterior clinoid processes were atrophic. Microscopic sections of the carotid in its cavernous sinus portion and of the wall of the sinus, showed internal thickening. Elsewhere there were tuberculous peritonitis, old pulmonary apical induration, bilateral tuberculous salpingitis, tubercles in the spleen and liver, granular atrophy of the kidneys, gall stones, and slight hypertrophy of the heart. No general arteriosclerosis. Riehm quotes several cases from the literature with findings similar to those in his patient, and concludes that the bilateral arteriovenous aneurysm arose from rupture of the internal carotid following thrombosis of the cavernous sinus in the course of, or as a sequel to, the attack, of influenza which marked the beginning of the patient's symptoms.

Seyfarth's patient, a man of 22, had suffered a *crush of the head* four years before. He came now for pulsating exophthalmos of the right eye, diagnosed aneurysm of the carotid in the cavernous sinus. The lids were swollen and veins large and tortuous. The external and internal carotid were tied, and magnesium needles thrust into the tumor in the forehead. Death from sepsis occurred nine days later. **Weber** saw a young man in whom a ball entered the left maxilla and had come out near the right ear. Some weeks later there was pulsating exophthalmos. Ligature of the carotid gave a good result without cerebral complications.

Wheeler reported on the case of a patient who had been in several accidents, each followed by diplopia which then disappeared. Following an attack of pneumonia, he again developed diplopia and bruit, which have persisted. At present there is marked dilatation of the bulbar conjunctival vessels, particularly the veins, worse in the left eye. The pupils are equal in size and have normal reactions to light and accommodation. The retinal veins of the left eye are dilated, but not tortuous. Interior of each eye normal, no dilatation of veins of eyelids, forehead or face.. There is complete paralysis of the left 6th cranial nerve, with resultant convergent strabismus. Exophthalmometer readings are 17 mm. for right eye and 21 mm. for left. There is definite palpable pulsation of the left eye, and this becomes visible under slight pressure by the fingers. When the patient leans forward there is no increase in the exophthalmos.

Two questions arose: whether to operate for the paralytic strabismus and whether operation for ligitation of the internal or common carotid artery of the left side should be done. It was decided that neither procedure should be undertaken, as the possible resultant effects are not worth the risk and uncertainty of operation.

Merigot de Treigny gives a brief report of a case of *spontaneous exophthalmos.* In four months the following phenomena appeared in the eye of the patient; complete ptosis, nonpulsatile, partly reducible exophthalmos, edema of both lids, later on souffle and thrill.

Before any operative procedure, compression of the carotid was done, but could not be maintained for more than a few seconds. Ligation of the orbital veins was at first attempted, but had to be abandoned because of a profuse hemorrhage which necessitated ligation of the primary carotid. The operative results were as follows: souffle and beating stopped instantly. On the sixth day there was discovered a large central ulceration of the cornea with hypopyon, manifest hyperesthesia of the cornea and lids, especially in the external segment. Two months after operation, the cure of the exophthalmos has been maintained, but for the past week mental disturbances suddenly appeared without motor or sensory trouble.

Ferrero gives a review of the symptoms, pathogenesis and therapy of this condition, and advises the *ligation of the internal carotid* in preference to that of the external carotid, because the collateral circulation is less likely to be established. His case was one of a girl of 23, who suffered a fracture of the skull in an automobile accident. On regaining consciousness, she felt an intermittent noise in the right ear and severe pain in the right temple. Gradually the right eye protruded. After four months, there was right exophthalmos, with pulsation, abducens paralysis, great dilatation of the episcleral vessels and noises. Two months after ligation of the internal carotid, all symptoms except the paralysis had disappeared or improved.

Gomes reported a case of pulsating exophthalmos dependent upon rupture of the internal carotid into the cavernous sinus, which was cured by ligation of the common carotid.

Aievoli surveys the experiences to date with shutting off the circulation in the carotid, especially for pulsating exophthalmos. Ligation of both common carotids and of the ophthalmic vein seems to insure more permanent results. Enough cases have been successful to justify consideration of ligation of the ophthalmic vein as a routine procedure.

EXOPHTHALMIC GOITER, ETIOLOGY AND TREATMENT.—**Schmidt** rejects the seven current theories in vogue as to the etiology of exophthalmic goiter, and declares that the evidence to date seems to indicate that the thyroid secretion becomes changed in some way, which increases its power of dispersion. Owing to this extreme dispersion, the follicles are damaged, and regenerative proliferation of epithelium follows. The microscopic and chemic tests for colloids confirm the essential difference between exophthalmic goiter and simple *hyperthyroidism.* Operative reduction of the thyroid reduces the secretion to correspond, and the hampered circulation may modify the dispersion property.

The operation, however, is likely to flood the blood temporarily with this substance from the thyroid. In hyperthyroidism, the thyroid secretion is an unfinished product, but it exerts a toxic action. In exophthalmic goiter, on the other hand, the secretion is an overdeveloped, overripe substance. The findings with the colloid chemical tests are tabulated from a large number of cases, especially the different characteristic responses to treatment of the blood serum with potassium iodid and silver nitrat, followed by a hydrochinon photographic developer, also the diverse behavior of the freezing point in hyperthyroidism and in exophthalmic goiter.

Bircher has written a brief article on exophthalmic goiter and hyperthyrotoxic adenoma, describing the method of investigation on goiter as carried on at the Mayo Clinic. **Romanis** has urged the benefit of surgical treatment for bad cases of exophthalmic goiter.

Bram writes that in exophthalmic goiter, the observance of the psychic factor is manifestly of vital importance. In his series of patients, 50%, prior to the institution of nonsurgical treatment, had submitted to surgery in one way or another and were either partially or not at all improved, or were markedly worse off than ever. He believes that *psychic instability* is a factor in the production of true exophthalmic goiter (as distinguished from adenoma of the thyroid) and emphasizes the importance of psychic therapeutic procedures by the internist, the roentgenologist or the surgeon.

Goldenburg reports the case of a child about six years old, who was brought to the clinic with the history that her eyes seemed to be growing larger for the past six months. A picture taken of the child about a year previously revealed no such condition. He found upon examination that there was a von Graefe sign, a Stelwag sign, and a hippus. The pupils were equal. X-ray and neurologic examinations were negative. Examination by an internist disclosed nothing, with the possible exception of an enlarged thyroid. He states he found no evidence of hyperthyroidism. Vision right eye was 20/20, left eye 20/25. The ophthalmoscopic findings were negative with the possible exception of a venous pulsation. He was fully inclined to think as did Dr. Gill, the neurologist, that the condition was an *endocrin* proposition.

Rowstron reported a case of exophthalmic goiter in a child, 4 1/2 months old, suffering from congenital *syphilis*. **Larsen** exhibited a patient with marked bilateral exophthalmos with violent *chemosis*. The right lobe of the thyroid gland was removed, and six months later the exophthalmos was increased, together with increased chemosis. His metabolism was normal and he showed no other symptoms of Basedow's disease except his exophthalmos. He showed some symptoms of myxedema. Operations were done on the chemotic conjunctiva and the cornea protected from keratitis, but in spite of precautions both corneas developed leucomas.

He was treated with Extra. Belladonnae, ctgr. 5, x 3 from Feb. 19 to Apr. 23. Pill Iodet ferros, 2 pills 3 times a day, from Apr. 23 to May 8. Thereafter he was given 5 ctgr. of thyroidin once a day. He was also given aspirin and sleeping powder. The exophthalmos and chemosis subsided after treatment, and when he was discharged there was only a thin rim of chemotic conjunctiva.

Achard and **Thiers** presented a patient, 22 years of age, suffering from exophthalmic goiter, in whom there was on the right side more marked exophthalmos without dilated pupil, hemihypertrophy of the breast, of the face and of the upper and lower jaw, and vasomotor disturbances in the upper limb. There was also present glycolytic and myocardial insufficiency. The authors do not think that sympathetic tonus due to the hyperthyroidism accounts for all these phenomena.

Holst declares that the relationship between the thyroid gland and the *pancreas* explains the glycosuria sometimes noted in exophthalmic goiter. The pancreas is evidently responsible for the severer forms of *glycosuria* under these conditions. He reports 8 cases of exophthalmic goiter with not only alimentary but spontaneous glycosuria, including 3 which must be considered as a combination of exophthalmic goiter and true diabetes, the symptoms becoming aggravated or attenuated in each to correspond. In 9 cases of exophthalmic goiter, on record, the pancreas was found pathologic.

From these and other data cited, he draws the practical conclusion that tests for sugar should always be applied as a routine measure in cases of hyperthyroidism, and that diabetics should always be examined for hyperthyroidism symptoms. If sugar is found in a case of exophthalmic goiter, the patient should be put on a strict antidiabetes diet. On the other hand, if symptoms of hyperthyroidism are found in a diabetic, we must consider the possible benefit from reducing the size of the thyroid, thus doing away with part of the factors responsible for the clinical picture. The depressing effect of the roentgen rays on the thyroid might be utilized. The inhibiting action on the pancreas, normally exerted by the thyroid, becomes excessive when the thyroid is functioning to excess; reducing thyroid function will release the pancreas from this pathologic influence, and reduce the requirement of calories. Diabetes thus steps into line as a surgical affection, he says, while exophthalmic goiter joins the list of metabolic disturbances amenable to diet. The details of 20 cases of combined hyperthyroidism and sugar intolerance are given, with the necropsy findings in some.

Double *luxation of the eyeballs* was seen in a case of exophthalmic goiter and reported by **Parker**. A male, age 60, had noticed bulging of eyes for several months. The onset was indefinite. Seven weeks before admission to hospital, he noticed an increase in bulging and decrease in vision, with blindness one week before admission. Occupation, handling heavy sacks of coal. Examination: patient undernourished, general weakness, tachycardia, tremor, and moist skin. Wasserman +1. General examination negative except for all the signs of hyperthyroidism. Basal metabolism, 1st test 50% over normal, 2nd test 76% above normal. V. O. D. light perception. V. O. S. nil. Both eyes luxated, lids being partially closed back of equator of globe, ocular movements present but limited. There was a marked exposure chemosis of globe not covered by lids, and a mucopurulent discharge covered both eyes. The entire cornea in both eyes was infiltrated and edematous, with a large central ulcer in both eyes and a perforation of cornea in left eye. Exophthalmometer reading, right 24 mm., left 23 mm. Enucleation left eye was refused.

Treatment: rest in bed and diet. The corneal ulcers were treated with silver and argyrol. After two weeks, an attempt was made to reduce the proptosis by bandaging. In six weeks the lids could be closed over the eyeballs, and in two and one-half months lids could be closed. The author suggests that, assuming that congestion of the orbital blood vessels plays a part in exophthalmos, the lifting of heavy weights by the patient was a contributing factor in the marked exophthalmos.

Foss has given a brief review of the entire field of exophthalmic goiter. Myxedema following treatment of Graves' disease with Roentgen ray is reported by **Seymour**, who published in 1916 the results of the treatment of Graves' disease by the *Roentgen ray* in a series of patients at the Massachusetts General Hospital. In 1919, Holmes and Merrill gave the results of their treatment of 262 patients also suffering from Graves' disease. This work has been continued and additional reports will be published in the future. In the routine treatment of these cases during the past year, the results in two of the cases have been especially interesting, in that probably as the result of treatment the condition of the patient has passed rapidly from a state of thyrotoxicosis to one of hypothyroidism, or a condition simulating myxedema. The lowered metabolic rate was raised by administration of thyroid extract.

Orbaan attacks the paper by J. E. Schulte (O. L. v. 17, p. 401), in which the danger, of using X-ray for Graves' disease are emphasized exclusively, no mention being made of beneficial results obtained in other countries, where radiotherapy is fully developed. In Holland radiotherapy is in its infancy. Orbaan says Schulte's arguments all turn on one case, in which operation had to be resorted to in the end: in this case extensive adhesions necessitated sacrificing some of the muscles of the neck, but there is no proof that the adhesions were wholly the result of the X-ray. Orbaan asks: what about presence of adhesions previous to X-ray—did the thyroid get larger or smaller following radiation—how much time had elapsed between radiation and operation, how was radiation applied, dosage, intervals, etc. All of these important points are not given in Schulte's article. Schulte at one time advocated X-ray for trifacial neuralgia. His sudden change of front is bewildering to say the least; his arguments about mortality from X-ray in Graves' disease, as compared with operative mortality lack logic, since operative mortality can be traced definitely to the operation, and this cannot be said of radiation—deaths among patients having X-ray treatment are not necessarily the result of the radiotherapy, whereas operative deaths are intimately connected with the operation itself. Orbaan states he prefers operation in many conditions, certain types of cancer, large myomata, that he is not of those who believe in X-ray for tuberculosis, but that he believes that in five years time ray treatment will be used by preference for hypertrophic prostates and in selected cases of hyperthyroidism.

He has used X-ray with apparently good results on a number of cases; these will be reported in detail later. He mentions one case now of a man 39, with rapid loss of weight, pulse 140-150 at rest, neck measures 35 cm., patient weak, severe diarrhea, sweating and tremor, no exophthalmus, palpable thyroid, patient seen Oct. 7, 1920. X-ray Oct. 7-13, daily treatment, 3 areas treated, distance 24 cm., 1/2 mm. zinc filter, each area 5 Holzknecht at the time, radiated twice during above period. X-ray again Oct. 27, has gained in weight, was 48 now (Nov. 4, 1920) 61 kilo. 3rd X-ray Jan. 26, '21, weight 66 kilo, neck 33 cm., pulse 100, good quality, can do his work—no more perspiration (formerly profuse) no diarrhea, bowels regular.

ENOPHTHALMOS.—**Pichler** reports in full the histories, clinical findings and autopsy findings of two cases of traumatic enophthalmos. There is also included a condensed tabular report of three previously reported cases.

The first case was that of a soldier who died in the hospital of carcinoma of the stomach and liver. Seven months prior to this, he had fallen from the second story of a building, striking the ground on the left side of his face, with resulting unconsciousness. On admission to the hospital shortly before death from malignancy, he showed in addition to his general findings a very marked left sided enophthalmos. With Hertel's exophthalmometer, right eye 13, left 1 mm. There was a left abducens paralysis. Reflexes and fundi were normal. The left orbit appeared enlarged, thru a recession of the lower margin, altho no notch or callus could be felt. At autopsy there was found a marked deficiency of the fat in the left orbit, as compared to the right side. There were no adhesions pulling the globe backward in the orbit. There was a marked deficiency of bone on the inferior and mesial margins of the orbit. Thus there was an absolute and relative enlargment of the left orbit, absolute thru partial bony deficiency, and relative thru a deficiency of fat.

The second case, a man age forty-two, was thrown several meters thru the air on June 19, 1913, and landed on the left side of the head. He was brought into the hospital in an unconscious condition. Examination showed marked bleeding from the ear and nose; left side of the head and parietal bone greatly swollen, also lids of the left eye. An irregular fracture was found on the inner and on the upper margin of the left orbit. There was also a left facial paralysis. Two months later patient was discharged with left facial paralysis and deafness; left pupil wide and rigid, and a notch in region of the trochlea.

On March 21, 1920, patient reentered the hospital in a very nervous and rundown condition, and showing also a very marked left sided enophthalmos. The general diagnosis was multiple brain and cord sclerosis. The eye findings showed a left enophthalmos and lagopthalmos, together with a deep notch in the upper inner orbital margin of the left orbit. The left eye was 2 mm. behind the right in the sagittal plane. The sizes of the orbital entrances in the vertical meridians were, right 28 mm. and left 30 mm. Extraocular movements were normal; left palpebral fissure and pupil narrower than right, and the reflexes were normal to accommodation and sluggish to light. Vision, right 4/6, left 3/10, color fields normal, both eyes. Death occurred March 30 and autopsy findings were those of a multiple sclerosis. Examination of the orbits, showed the left bony roof to be flattened with an old fissure in the middle, bridged with connective tissue. Interior of the left orbit showed a marked absence of fat except in the anterior portion.

In the tabulated report of five cases, three of which were reported previously and two in this article, the author shows that the fat content of the affected orbit was markedly reduced in three of the cases, and that there was an absolute increase in size of the orbits due to bony changes in four cases. In no case was there found scar tissue or adhesions which could account for the enophthalmos.

INTRACRANIAL ANEURYSM OF THE CAROTID ARTERY.—It has generally been regarded as impossible to diagnose an intracranial carotid aneurysm during life, but **Möller** compares with a case personally observed from the literature, and thus demonstrates that a special clinical picture is observed which can scarcely fail of recognition when once beheld. It begins as a progressive paralysis of the oculmotor muscles of one eye, with impairment or even complete loss of vision in this eye. The papilla may be atrophic, but there is no choked disc. Neuralgia and other sensory disturbances may be observed, with paresis of the third, fourth and sixth cerebral nerves, and finally, of the fifth nerve. The other cerebral nerves seem to be normal, and the eyeball does not protrude as a rule. Headache is a constant symptom, as also tinnitus. The condition may be stationary for years. In the six cases tabulated, there had been an interval of from eight to eighteen years since the first symptom. The absence of cerebral disturbances further characterizes this clinical picture. Treatment as for syphilis should always be given a trial, as it is impossible to exclude syphilis as a factor without. Little if any benefit has been derived from prolonged pressure on the common carotid artery, and ligation of the artery within the skull is fraught with too much danger, but a ligature might be thrown around the artery outside the skull. This might protect against the otherwise inevitable danger of increase in size, and rupture. He urges that the ophthalmologist or the neurologist who first recognizes the affection should advise this treatment. Subcutaneous infusion of gelatin has been tried but without much result. This is worth a trial before resorting to other measures.

THROMBOSIS OF CAVERNOUS SINUS.—Thrombosis of the cavernous sinus is discussed by several writers. **Reese** reported two cases of cavernous sinus thrombosis, the first unilateral and secondary to an *otitis media.* Autopsy showed that the cavernous sinus had become involved by extension thru the bone along the course of the carotid canal. The causative organism was the streptococcus hemolyticus. The second case was bilateral, and resulted from a *nasal furuncle.* Autopsy was not obtained.

Key-Aberg reported a case of thrombosis of the cavernous sinus due to *empyema of ethmoid and sphenoid* cells. He discusses the neurologic symptoms caused during the progress of the disease.

Haedo reported a case of thrombophlebitis of cavernous sinus of a patient who punctured a small furuncle in the right ciliary region with a hot pin. Fever, nausea and right sided headache followed. That night there was a vomiting of cerebral type. In the morning the eye was swollen. Soon the other eye became inflamed. Great bilateral exophthalmos. Eyelids very edematous, cyanotic. Very painful. General condition very bad. A few hours after examination by the author, the patient sank into a coma, and died the next morning. The diagnosis was that of thrombophlebitis of the cavernous sinus. The author offers no treatment, as he says these cases are invariably fatal.

Infections of *dental* origin are extremely frequent, and are not always of a benign nature. Among the complications which may arise, propagation of the infection to the sinuses or the meninges is especially to be feared, altho its occurrence is rare. In the case reported by **Lauret**, a child had a dental abscess in the region of one of the inferior molars on the left side. It was not properly opened until 10 days after onset. Altho marked improvement followed, about a week later the following signs of thrombophlebitis of the cavernous sinus on the left side were noted: palpebral edema, exophthalmos. dilatation of the pupil, paralysis of the external rectus of the eye, with high fever and weak pulse. Symptoms of meningitis developed later and the child died. Autopsy confirmed the diagnosis and showed the presence of an abscess in the left cavernous sinus. The origin of this infection could be traced step by step to the inferior dental veins.

Tremolieres' patient was suddenly seized with violent pains in the left orbit and temporal region, with left exophthalmos. A few days later there appeared a homonymous and vertical diplopia, increasing at a distance, above and below, due to paresis of the left 3rd and 6th nerves. There was a little hyperemia and blurring of the optic papilla. There was also increased in size a previously present goiter. In six weeks there was lessening of the exophthalmos, and pain and diplopia was present only on looking to the left. Five months later there developed suddenly a *diabetes insipidus*, with tremor of the extremities, loss of weight and strength, occipital headache and somnolence and tachycardia. Symptoms somewhat controlled by pituitrin. No return of ocular signs. The patient was able to serve thru the war in the auxilliary, and in 1921 his symptoms were much improved, 'normal pulse, no goiter, no tremor, no diuresis. There had been no treatment. The author suggests some undertermined disease with enlargement of the posterior lobe of the hypophysis as the cause of the symptoms.

Hoston argues, that on account of the complicated connections, a thrombosis of the sinus cavernosus will arise from infection in the face, in the nose and its accessory cavities, in the mouth, throat and ears. An infection of the ear is usually secondary, but may be primary. Diseases of the accessory cavities are very often caused by sphenoid empyemas. The extension to the endocranium is mostly caused by a thrombosis of the veins of the diploe, and by carious destruction of the sella turcica. An infection of the sinus cavernosus is most often introduced thru the orbit. The ethmoid cells are seldom affected alone, nor does the disease often start in the maxillary sinus. On the other hand, the disease is frequently caused by tonsillitis and by peritonsillar and retropharyngeal abscesses.

The local symptoms are of two kinds, congestion of the orbit and symptoms from the adjoining nerves. The congestion of the orbit is characterized by edema of the eyelids and conjunctiva, as well as by exophthalmos. There may also be congestion of the forehead, the nose and the cheeks. Nose bleed has been observed in some cases. The second group of local symptoms consists of paresis of the oculomotorius and abducens, abnormal position of the eyeballs and ptosis, with dilatation of the pupil. Pain is an early symptom. It is partly of a neuralgic character and partly headache localized to the forehead or occiput. Pyemic fever, often accompanied by attacks of rigor, is a general symptom. The prognosis is unfavorable, most cases terminating in death.

ORBITAL THROMBOSIS.—**Meisner** reports, as a case of one sided thrombosis of the cavernous sinus, a thrombosis of unknown etiology, which produced atrophy of the eyeball. A youth of 17, after two days of violent headache and pain in the right eyelid, presented conjunctival but not ciliary irritation. The anterior chamber was full of blood. Next day there was great swelling of the lids, protrusion of the eyeball and loss of movement. In five days the swelling was less. In ten days the hemorrhage into the anterior chamber began to be absorbed, the iris became visible, with the pupil widely dilated. Later the iris appeared atrophic and there was no fundus reflex. A month later the whole eyeball was atrophic. (Altho Meisner states that all symptoms of a thrombosis of the cavernous sinus were present, it seems more probable that the process was confined to the veins of the right orbit and eyeball.) The ordinary causes of thrombosis, marasmus, infection, local or general, and trauma seem to have been absent.

ORBITAL CELLULITIS.—**Angello**, in writing of *phlegmon* of the orbit due to ethmoidal *sinuitis*, states that such a condition is generally the acute evolution of a chronic suppurative process. The case described is unusual, being primarily acute. A girl of 16 required an emergency operation for a condition in which the left eye was in marked exophthalmos, with eyeball pressed uniformly forward, the palpebral rim closed, edema and intense redness of the lid, especially toward the internal angle of the orbit. Pressure caused violent pain and a sense of deep fluctuation. The bulbar conjunctiva was strongly chemotic, with pupil in slight mydriasis. The temperature was 39.5°C. The patient had suffered for over three months with purulent nasal catarrh, headache and heaviness. One week before observation, ocular pain and fever had set in, followed within forty-eight hours by protrusion and chemosis. At the same time the nasal discharge stopped completely.

Nasal examination showed the left nasal mucosa edematous, with hypertrophy of the turbinates, especially the middle, and numerous small polypoid masses covered with dense strata of yellow-green secretion. There was evidently an open ethmoidal empyema of the anterior cells, which had found its usual nasal outlet obstructed and so had invaded the orbit. As there was imminent danger of the suppuration reaching the endocranium, an operation was at once performed. Preliminary exploration with a needle failed to discover the pocket. Incision, however, caused an outflow of thick pus. Accurate examination showed the papyraceous lamina of the ethmoids denuded of periosteum and eroded in spots. After careful cleansing, a packing of gauze impregnated with picric ether (2%) was inserted. The next day the fever dropped and pain ceased; and in five days the exophthalmos and edema had practically disappeared. Medication and frequent curettings were continued for twenty-five days and in a month's time the wound closed without a fistula and with only the most trifling linear scar. An interesting feature was the reappearance of the nasal discharge, which resumed its natural course and was referred to a rhinologic clinic. The importance of sinuitis is being constantly more recognized in the etiology of the orbital and ocular complication, for it is not at all uncommon for the process to leave the cavity of the sinus and make its passage across the orbit, resulting in the formation of a phlegmon capable of the gravest complications in the brain or optic nerve.

Fialho reports a case of orbital cellulitis in which no cause could be found, so he concluded it was due to embolic metastasis. **Savage** also described a case of orbital abscess in which the cause was not determined. Phlegmon of the orbit arising from dental infection was found by **Birnbacher, Rousseau-Decelle** and **Berscher**, and others.

TUBERCULOSIS.—According to Birch-Hirschfeld, tuberculosis of the orbit occurs mostly at the orbital margins as caries and tuberculous periostitis. A second form, tuberculosis of the retrobulbar tissue, is more rare and its diagnosis is difficult. Clinically and anatomically it is often mistaken for malignant tumor (round cell sarcoma or lymphosarcoma). In a case described by **Meisner**, exophthalmos, diminished mobility of the eye, impairment of vision, edema of the disc, retinal edema, dilatation of the veins and narrowing of the arteries, led to the performance of a *Krönlein operation.* A soft tumor, originating from the ethmoid and proliferating into the orbit, was found. Macroscopically, it was considered a carcinoma and microscopically a round cell sarcoma. Recovery followed evisceration and removal of the sphenoid and ethmoid. Examination of the specimens disclosed tuberculosis of the orbital tissue, in which a few tubercle bacilli were found.

The primary focus of tuberculosis of orbital tissue must usually be sought outside of that tissue, in the sphenoid or in the meninges. In the foregoing case, the disease certainly originated in the posterior ethmoid cells. That there are not on record more cases of orbital tuberculosis with the primary focus in the posterior accessory sinuses, is due to the difficulty of making a diagnosis of primary tuberculosis of the posterior sinuses, inasmuch as tuberculosis of these is in itself a rare condition. As tuberculosis of the bones is more frequent in juvenile patients (the author's patient was a woman, age 52), it is believed that the ethmoid was secondarily infected from the mucous membrane, causing the destruction of the lamina papyracea and invasion of the orbit. In all orbital tumors, the possibility of a tuberculous process should be considered.

STREPTOTHRIX IN ORBIT.—A man of 62 was seen by **Pascheff** after he had suffered for two and one-half years from left exophthalmos with a periorbital fistula. Twenty-eight years before he had received a blow on the left brow, and thirteen years later he had suffered from small abscesses of the left half of the brow in the neighborhood of the orbit. Under potassium iodid the fistula healed. Two years after this he came with total blindness of the left eye, headache and poor health. There was also a large tumor in the temporal region of the left side. The orbital tumor was removed, including the optic nerve to the foramen and the outer bony wall of the orbit was found adherent to the growth. On microscopic examination both at the time of the treatment of the fistula and of the tumor removed from the orbit, a ray fungus was found and cultivated, and closely identified with streptothrix with farsinici bovis.

OSTEOMYELITIS.—Acute osteomyelitis of the small wings of the sphenoid is discussed by **Cange.** He believes that abscesses of the orbit are of double origin. The first arise in consequence of septic inoculation of the celluloadipose tissue by a penetrating wound, complicated or not by the presence of a foreign body; of metastatic localization from a general infection; or, a propagation in the depth of the orbit of an infection in the anterior portion of the eye. The second arise from the walls themselves. These are of complex and variable structures; above, within and below, the orbital cavity is bounded by the frontal, ethmoidal and maxillary sinuses. Pus may erupt from these cavities into the orbit, but sometimes the bone is involved from the first and on its own account, a primary, acute osteoperiostitis; this may be simple or specific, tubercular or syphilitic. Localization may be in any part of the osseous funnel without appreciable modification of the symptomatology; may be marginal, or at the apex of the orbit.

The case reported is that of an adolescent of 16 years, attacked suddenly with a prolonged chill and high fever with severe headache; a purulent collection in the depth of the orbit; after incision and evacuation, general symptoms persisted while the local condition cleared up, with interminable period of secondary fistulization. This was succeeded by a secondary period, characterized by meningeal reactions and infection of cerebral substance, a large circumscribed abscess in the temporal lobe, ending in death. At autopsy the original osseous lesion was discovered occupying the extreme point of the orbit; two sequestra were removed, one of which was the small wing of the sphenoid, which showed all the attributes of an osteomyelitis, solidly establishing the existence of a primary focus.

DISEASES OF THE SINUSES AND THE ORBIT.—**Nelissen** noted a case of *gumma* of the maxillary sinuses and orbit. He treated it with potassium iodid and obtained relief of nearly all symptoms after two months.

Suñe y Medan had to resect part of the upper wall of the orbit on account of *necrosis* of the bone, in a child of 12, who had had three operations for recurring abscess in the upper lid within eight months. The frontal sinus was then curetted thru this opening and swabbed with iodin, and the head of the middle turbinate bone was resected to insure better drainage. The sinus had to be cauterized with chromic acid and silver nitrat in addition, before the rebellious discharge was conquered, but healing was complete in two months.

Warlow reports a case of a woman. 48 years old, who had marked exophthalmos of both eyes resulting from purulent ethmoid and sphenoid cells. After 14 months duration, the exophthalmos was relieved by exenteration of the ethmoid and drainage of the sphenoid cells.

The patient of **Cange** with *giant mucocele* was a man of 33; who, five years before, had noticed a small tumor at the upper inner angle of the orbit. This had slowly increased in size, and after 2 years exophthalmos was noticed. The continued extension of the tumor had produced great enlargement of the orbit and complete dislocation of the eyeball. Radiographic examination revealed the enormous extension of the orbit shown diagrammatically in Fig. 14. Operation was advised but refused. Nearly 2 years later the patient returned in the condition shown in Fig. 15, and submitted to operation. An incision 6 cm. long was made at the lower margin of the eyebrow to the fibrous wall of the cyst, which on account of its extent was then opened. The greenish, viscid, almost gelatinous contents did not escape spontaneously, but were removed with a spoon. The sac was carefully dissected out with curved scissors exposing the dura mater. The frontonasal canal was obliterated, so that a tunnel had to be made with a sharp curette extending into the nose. Healing was normal and the patient was discharged at the end of 4 weeks with some divergent strabismus, the eye still lower than its fellow and upward movement of it limited. Fourteen months afterward the patient's appearance was as shown in Fig. 16. The ophthalmoscope showed the disc margins indistinct, but corrected vision was 0.5, and the visual fields normal. The contents of the cyst were found sterile.

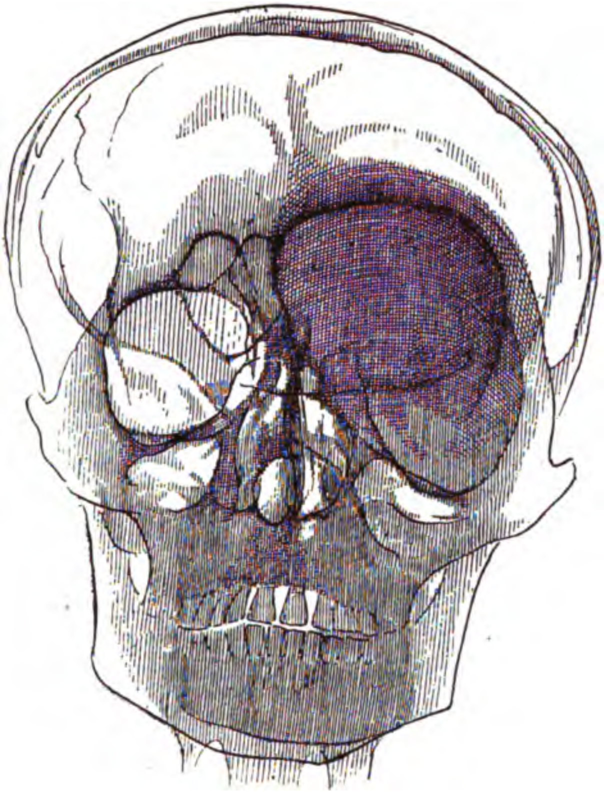

Fig. 14. Diagram from radiogram showing enlargement of orbit by giant mucocele (Cange).

Orbital Complications in Scarlatina.—Orbital inflammatory symptoms were observed by **Salomonson** in a series of scarlatina patients, which must certainly be considered as orbital complications caused by the catarrhal condition in the nose. In 3 years, the author had treated 20 such cases in scarlatina patients, 3 of which were bilateral.

Nearly all of these were children. The results were uniformly good, altho some of the cases presented an alarming appearance. Only in 2 cases was surgical intervention resorted to. It was impossible to obtain Roentgen pictures. The diagnosis was only verified in a few cases by operation, but the disease picture is so characteristic that the diagnosis leaves little room for doubt. This complication may arise early or late in the course of scarlatina from the 3d to the 47th day. Of the 20 patients, one was over 15 years of age and 11 under 5 years. In such young patients, the origin is usually ethmoiditis.

In most cases the disturbances of the orbit are limited to an inflammatory edema, altho there may of course have been pus which has been discharged thru the nose. The disease has an acute beginning. It is suddenly discovered that patient's eyes are quite closed from edema of the lids. The leading symptom is protrusion of the bulbus and limited movability of the bulbus. The protrusion of the eye is often marked. The limitation of movability may be due to pus or edema, or more rarely to the effect of the inflammation on muscles and nerves.

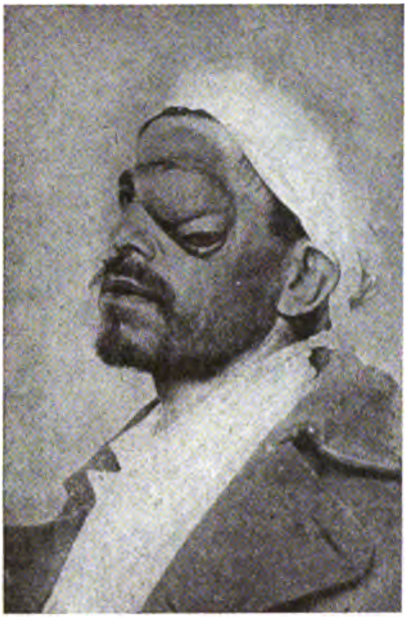

Fig. 15. Displacement of eyeball and swelling from chronic mucocele, before operation. (Cange)

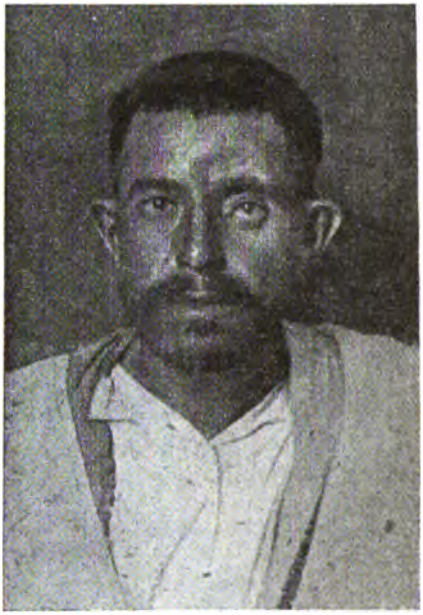

Fig. 16. Result of operation for mucocele, appearance 14 months afterward. (Cange).

All patients have been shown to have pus in the nose, violent redness and swelling of the mucosa. No disturbances of the inner eye were observed. A constant symptom is high fever 39°-40°. Chills were not observed, and no signs of brain involvement. The disease usually lasts from 3 to 4 days or 8 to 10 days before the symptoms disappear. In a few cases, the disease has lasted as long as 20 days, and recovery with 2 exceptions was spontaneous. Diagnosis is unusually difficult. The sudden onset of the disease together with purulent nasal discharge is characteristic.

The author concludes that all cases complicating scarlatina have a benign course after conservative treatment, even tho they may present an alarming appearance with protrusion, diplopia, etc. Ten of the 20 patients reported for after examination and were in normal condition.

Lemaitre considers under the term sinuitis only acute and chronic catarrhal or suppurative inflammation of the mucosa of the sinuses. He discusses the anatomy of the nasal accessory sinuses in relation to the orbit; showing, among other facts, that lacrimal fistulae can arise in connection with frontal and maxillary sinuitis as well as with anterior ethmoiditis, and that posterior ethmoiditis can cause optic neuritis without the presence of sphenoiditis. He also calls attention to the considerable resisting power of the orbital periosteum to the penetration of pus, tho its easy detachment gives rise to subperiosteal abscesses; while Tenon's capsule, on the other hand, offers little hindrance to infection of the eye itself, once the orbit is invaded. He gives tables showing the possible complications of affections of the various sinuses, their type, usual site, etiology, prognosis, and treatment. Orbital complications occur in about 1 to 2 per cent of sinus cases.

The infecting organisms are many and varied. According to Morax, streptococci infections travel along the lymphatics, pneumococci extend by contiguity, and infection of the globe, which can occur along venous or arterial channels, usually takes place following corneal ulceration as result of the exophthalmos, or of the trophic disturbances because of involvement of the ophthalmic ganglion. Under the suppurative type, Lemaitre includes osteoperiostitis, orbital phlegmons, and palpebral abscesses, which make up more than three-fourths of the orbitoocular complications of sinuitis. Their symptomatology, which is given in detail, may be either acute, subacute, or chronic. The end stage of all these, unless they are fatal or properly treated in the acute stage, is fistulization. Under the inflammatory type, he mentions acute transitory edemas of the lids and orbit which subside under intranasal treatment of the sinuses, but which if left alone, may pass into the suppurative variety.

Under the monopathic type, he groups such complications as retrobulbar neuritis, or juxtabulbar neuritis with papillitis (due either to sphenoiditis or to a serous orbital cellulitis from frontal, maxillary, or ethmoid sinuitis), external ocular muscle palsies, affections of the sensory or trophic nerves of the orbit, iritis, chorioretinitis, vitreous opacities, detachment of the retina, dacryocystitis and pericystitis, and cavernous sinus thrombosis. The prognosis varies, but should be guarded in cases of orbital inflammation of whatever type. Roentgenograms help in the diagnosis; but care must be taken to differentiate between the orbital complications of sinuitis and periorbital erysipelas, acute dacryocystitis, orbital tumors, syphilitic periostitis and osteitis, tuberculous and traumatic osteitis, dental osteitis and cysts and mucoceles.

In the treatment, it is often possible to treat the sinuitis and the orbital complication by the same procedure. In suppurative form operative interference is urgent. In cases of acute osteitis of the orbit, however, treatment should be confined to incision of the orbital abscess and the osteoperiosteal collection, as attempt at a radical sinus operation is very apt to lead to serious intracranial involvement. The inflammatory form without suppuration will subside with intranasal shrinkage and hot compresses; but if there is suspicion of the presence of pus, exploratory puncture or incision of the orbit should be adopted. In the cases of phlebitis, radical operation on the nasal and cavernous sinus is usually ineffectual; vaccin therapy may offer something.

The great difficulty of diagnosis in certain cases between *orbital phlegmon* and acute closed purulent frontal sinuitis is dwelt upon by **Caliceti.** In the case of a man of 22 there was tumefaction and redness of the supero-internal angle of the upper right lid, with marked exophthalmos and loss of vision. It was impossible to differentiate between frontal sinuitis and an orbital phlegmon. An incision was made from the supero-internal angle to the middle of the eyebrow; the periosteum was detached, and a perforation of the bone made by Citelli's modification of Collin's method. A small curved canula was introduced and the cavity irrigated. The irrigator, returning clear thru both the new orifice and the nose, at once excluded a sinuitis, either frontal or sphenoidal, as nasal and rhinopharyngeal symptoms were lacking.

The condition pointing, therefore, to panorbital phlegmon, the author made a deep incision of the orbital tissues excluding the periosteum, concluding with complete closing of the breach. Warm compresses were applied with injections of antistreptococcus serum. There was little change for three days, and at the end of ten days, swelling and exophthalmos had entirely disappeared and sight had in part returned. The incision had brilliantly served a double purpose by excluding sinuitis and relieving the contraction of the phlegmon. If it had revealed a sinuitis, the excavation offered a satisfactory outlet. If in this case the sinus had been opened by its anterior wall or thru the nasal cavity, another operation in another region would have been necessary, with danger of deformity and prolongation of the operation; or an artificial way would have had to be made, removing part of the middle turbinate bone and of the ethmoid, with loss of time and more danger of infection, while the orbital incision would have still had to be made for the phlegmon.

Plastic Operation.—**Wheeler** brings about correction of cicatricial ectropion by use of true skin of the upper lid. He describes a technic for plastic repair of cicatricial ectropion of (1) the lower lid by transplantation of a full thickness detached skin graft taken from an upper lid; (2) cicatricial ectropion of an upper lid by a similar graft taken from the lid of the opposite side. He claims that the idea was original with him. Lancaster said, in discussion: "If you want to get Dr. Wheeler's result, it is necessary that you closely follow his very careful technic. For instance, in dissecting the graft from the other lid he does not touch it with forceps, and he is careful to avoid all mechanical injuries and similarly all chemical or other injury of the tissue. All bleeding must be stopped, the lid of the graft must be carefully prepared, perfect apposition or contact secured, the lids immobilized, and the subsequent treatment must be very thoroly followed up, including massage."

Jacobi described two cases in which strips of fascia lata were used in the treatment of staphyloma. In the first case, the strip of fascia was covered with a flap from the scleral connective tissue. In the second, this could not be done because of cicatricial contraction of the conjunctival sac from trachoma. So a strip of mucous membrane the same size as the strip of fascia was taken from the lower lid and placed over the fascia, pushed under the connective tissue on the nasal and temporal sides and sutured to it. The fascia in both cases effectually prevented the recurrence of staphyloma. The second case shows that the nutritive demands of the transplanted fascia are very slight; otherwise they would not have been supplied by the transplanted piece of mucosa from the mouth and by the aqueous humor.

Heckel reported three cases of enucleation in infants, for intraocular tumors. In infants, he does an external canthotomy to facilitate expression of the globe. He does not favor implantation operations and does not believe that it makes any difference in the development of the orbit whether or not implantation is done. **Bordeaux** to prevent shrinking of the orbit, due to irritation produced from absorption of air behind the prothesis, makes a groove to admit air and prevent a vacuum.

Pichler shortened the lower lid by a lateral *tarsorrhaphy,* and made it more tense toward the temporal angle and upward, whereby he obtained a considerable pressure upon the lower part of the artificial eye. The resulting shortening of the palpebral fissure scarcely improves the cosmetic effect but often is desirable. A similar result might of course be effected by a wedge shaped excision of the posterior lid plate (Kuhnt's ectropion operation). In some cases, the shortening of the lid might effectively be combined with implantation of fat.

Weve referred to Zeeman's communication to the Society some years before, in which he had described a method to facilitate the wearing of an artificial eye when the conjunctival sac was small or the lower lid missing. He had four similar cases. In two the conjunctival sac had been contracted for years, so that when the patient attempted to open the lid, a tense membrane was visible. No lower culdesac existed, and an artificial eye had never been worn. The operation consisted of the cutting of a falx like skin bridge, where the fornix of the lower culdesac should be. The lower incision divided only the epidermis, while the upper penetrated to the conjunctiva. The skin bridge was turned inside and served as a fornix; it was sutured to the conjunctiva destined for the surface of the lower lid. If not enough conjunctiva was present, the surface of the wound had to be covered with Thiersch grafts. A small artificial eye, previously selected, was used as a prothesis; and the lids were temporarily sutured. For a few months in both cases, small abscesses appeared at the line of incision, retarding the cure. In the future, Weve would prevent the lower lid from becoming too thick; a partial tarsus extirpation may be valuable.

Key exhibited a case of *fat transplantation* without absorption of the transplant after seven and one-half months. This result he thought due to:

1. The recti muscles are sutured at the sides of the fatty mass and in the floor of the conjunctival culdesacs and, therefore, traction is not made upon the implant but upon the conjunctival attachments of the lids and canthi, thereby allowing normal growth of the fat in Tenon's capsule.
2. Tenon's capsule is entirely filled with one piece of fat from the front of the thigh.
3. The bleeding orbit is not to be irrigated with any solution, nor should bichlorid or other cotton pledgets be forced into it. On the contrary, pieces of gauze saturated in warm salt solution, are placed firmly in the bleeding orbit while the fat is being taken from the thigh. Unusual bleeding is checked before inserting the implant, but the implant is not taken from the leg until the orbit is properly prepared for it.
4. The bandage is firmly applied, the other eye bandaged (when the patient has become entirely conscious from anesthesia) and should remain bandaged for four or five days; dressing every two or three days with gauze saturated in warm salt solution, rubber tissue being used to retain the moisture.

Magitot uses formalized cartilage grafts implanted in the orbital cavity to form a prosthetic mobile stump. He at first used fresh cartilage obtained from the patients themselves, but as this was absorbed very rapidly he has been led to the formalized cartilage. **Dupuy-Dutemps** admits the advantages of Magitot's formalized cartilage, but prefers to use paraffin. **Coulomb** reported that a piece of costal cartilage inserted into an orbit after enucleation by Carlotti, five years previously, showed no shrinking.

The repair of the orbital cavity to permit prothesis is more than ever a question of interest, since to the list, already long, of accidents in civil life, are added the war injuries. **Terrien's** technic is as follows: As in all autoplasties, all trace of suppuration must have disappeared; if there has been dacryocystitis the lacrimal sac should be removed. Infiltration of the tissues with 2% novocain containing adrenalin gives perfect anesthesia. For preparation of the bed of the graft, an incision is made transversely from one canthus to the other, the length of the former palpebral slit. The two lids are detached. Too deep penetration is to be avoided; do not dissect up with the lids the subjacent orbital tissue. The lids are dissected carefully above and below just to the superior and inferior orbital borders. After having denuded the bone over a small area, the orbital cavity is ready to receive the graft. Care should be taken not to rub the raw surfaces and not to use any irritating solutions.

The graft flap, that it is now necessary to excise, should be of the form of the culdesac and intimately applied thereto. The graft may be taken from the inner surface of the arm, where the skin is sufficiently thin, or from the upper part of the thigh. The graft is excised in the usual manner with the razor. As soon as the graft has been removed, it is delicately seized by one of its borders with a fine forceps and rolled around a little wax mould previously made of the cavity, employing dentist's wax. The whole is then placed in the cavity which has been well dried; the ciliary lips are drawn together over it and held with one or two sutures. The dressings, in the absence of pain or reaction, are left for three or four days, and then superficially renewed. The wax mould is not removed until fifteen or twenty days later, when it may be removed with the aid of a small strabismus hook, slid gently under its surface.

Finnoff refers to a group of cases of contracted socket in which the socket is partially obliterated by scar tissue, which prevents the insertion and wearing of an artificial eye. In some of these cases, the conjunctiva has not been lost and all that is necessary is to reestablish the contour of the socket sufficiently to permit the insertion of a prothesis. He advises the use of dental impression compound for dilating purposes, then states that paraffin or wax may also be used for this purpose. He also advises the use of single strand suture material, such as horse hair, silk worm, or dermal sutures for plastic surgery.

Woodruff has had good results by use of skin grafts, put in by the well known method of placing Thiersch grafts on plates of lead or tin and fastening them in an artificial culdesac. **Mooney** used a piece of drainage tube to retain a Thiersch graft.

Finnoff operated on a man whose lower lid was greatly retracted by scar, which left an unsightly V shaped deformity. The upper lid was drawn into the orbit by a well marked band of scar tissue. This band was divided and a cast made of dental modelling compound was placed in the orbit to prevent union of the cut surfaces. Six days after this operation a small artificial eye was retained in the socket. Later the deformity was entirely corrected by a plastic operation, on both lids. This operation was analogous to the operation usually done for the correction of harelip, the deformity being overcorrected, so as to allow of the development of a normally shaped lid margin by subsequent cicatricial contraction.

Stout bands in an otherwise good socket can be as troublesome to rectify as a contracted socket itself, but they can be most effectively dealt with by the same procedure. One of the two curved needles of the suture is passed from within out, thru the fornix, close to one side of the base of the band and out on to the surface, and the other needle is similarly directed on the other side. The suture now being in good position but not tightened, the band is next divided, close to and parallel with the lid surface, to a depth approaching the fornix. The suture is now tied, with the result that instead of the former ridge its site is now marked by a slight depression which, and this is an important factor, is covered by mucous membrane brought together and approximated by the tightened suture.

Desax reports three cases of gunshot injury of the face, with destruction of the eyeball; and formation of a fistula between the shrunken and distorted remaining conjunctival sac and the nasal cavity, twice thru the ethmoid and once thru the antrum. The secretion from the remaining conjunctival sac caused a constant irritation and inflammation of the whole adnexa, so that a prothesis could not be carried. At the operation, the scar tissue was all removed, as well as the remains of the conjunctival sac and the eyelashes of both lids. The lids were brought together as much as possible, sewed together and, by means of a bandage, the new formed cutaneous covering was pressed as deep as possible into the orbit. The wound granulated completely after a half or one and one-half months. In one case, because of the size of the deformity toward the nose, a part of the remaining conjunctiva was brought down and sewed to the underlying tissue. In all the cases an orbit lined with epithelium was obtained, suitable for the admittance of a prothesis.

Takats describes minutely his plastic operation on the orbit, after removal of the eye. After exenteration, he establishes a free drainage into the nose thus transforming the orbit into a closed accessory cavity of the nose.

Tumors

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This section reviews the literature from September, 1921 to July, 1922. For previous literature see Vol. 17, p. 425.

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DIGEST OF THE LITERATURE.

Benign Tumors of Lids.—A mass on the margin of the lower lid near the inner canthus was found by **Duclos** to consist of epithelium that had undergone hyalin degeneration with formation of cavities containing mucoid substance. It seemed to have originated from the normal deep layers of epithelium. **Ellett** removed a *cyst* of the upper lid in a girl of 16. It was lined with round cells with well developed vessels in its walls. **Munoz Urra** gives a detailed pathologic description of a *keratoma* of the lid. Its structure was like that of a papilloma, with proliferation of the Malpighian layer, and of the underlying connective tissue. In the epithelial layer were massive deposits of keratin. Some areas showed the possibility of beginning malignant change.

Favaloro discusses *verruca* of the

palpebral border. His case, a girl of 8, had developed a nodule in the lower lid border six months before. Similar nodules developed beside it and on the upper lid opposite it, so that when first seen by the author, two-thirds of the lower and almost all the upper lid border were occupied by the growths, there being twenty in all. They were inserted at the roots of the lashes, which were turned out. Aside from one small nodule in the upper fold, the conjunctiva was unaffected. They were excised and their bases cauterized. The small ones were rounded, while the larger ones showed a fimbriated appearance from a division into lobes and lobules. All the strata of the normal skin were present in the nodules, and were of normal thickness, except the Malpighian layer, which showed marked hyperplasia. Tho only the usual saprophytes were found in culture, the author is convinced of the contagious nature of the growths, like papillomata elsewhere on the body, and urges their early excision before greater areas of tissue are involved.

MALIGNANT TUMORS OF LIDS.—**Davis'** case of *carcinoma* of the lower lid showed the damage done by treatment with socalled "cancer-pastes" made of arsenic, for under such treatment it had progressed to involvement of the conjunctiva, cornea, and upper lid, so that exenteration of the orbit was necessary. There was no recurrence after this last procedure.

Meyer describes his procedure in a case of extensive *epithelioma* of the lids at the outer canthus. After wide excision, a pedicled temporal flap was drawn over the raw area, at the primary operation.

Redaelli insists on the efficacy of proper treatment by *jequirity in epithelioma of the lids,* especially those of recent origin. By a special dressing of gutta percha he everts the lids, protecting the surrounding tissue, during the short exposure to the jequirity discs. This causes an intense reaction, and when this subsides, the membrane which has formed is removed and the application repeated. Later collyria containing copper sulphat are used.

On the theory that neoplastic cells are biologically closely related to sexual germ cells, **Deutschmann** immunized animals by injections of ovaries and testes of animals and, in a few cases, human beings, and tried the effect of these sera on human neoplasms. One epithelioma of the lid, which had resisted heavy X-ray doses, healed in four weeks after a course of injections into the region of the growth. There has been no recurrence after seven months. In another very severe case involving both lids, the growth was kept stationary for a year. During an interval of treatments, the growth progressed, but returned to the status quo when injections were resumed. Kotzenberg has reported favorably on this treatment in carcinoma of other regions.

NEVUS.—As examples of nevoid ocular growths, **Lamb** reports the microscopic findings in 4 cases. One affected the skin of a lower eyelid in a man of 56, where it had been noticed a year before and had been removed. It recurred within the last two months. Cell nests and proliferation were found that amply justified the diagnosis of basal celled carcinoma. Nevus cells were found in the connective tissue between the cell islets and became more numerous in the deeper portions. They were believed to play but a minor part in the development of the growth; altho Ewing's view that they give rise to melanoma is endorsed.

BENIGN TUMORS OF LIMBUS.—**Hugel** and **Worms** report a case in which a small yellowish spot had been noticed on the eyeball extending 1 cm. outward from the limbus. It had been noticed for several years, but in a few months had increased in size without pain but with slight recurrent inflammation of the conjunctiva. It was removed, being quite adherent to the sclera, and examined microscopically. They found that in structure it corresponded closely with the socalled dermoepitheliomas, described by Parinaud and Kalt. It showed epithelial masses, inflammatory cell cavities, irregular in size and disposition, which contained in them single or grouped polyhedral cells. Some of the epithelial cells were arranged in cylinders or nests. However, these authors believe that it is not properly an epithelioma, but a benign tumor originating in the glands of the conjunctiva, the socalled glands of Manz. These have hypertrophied and part have undergone degeneration or distention, giving rise to small multilocular cysts, the probable origin being repeated slight inflammations.

BENIGN GROWTHS OF CONJUNCTIVA.—**Green** has reported a *cyst of the caruncle* in a colored woman. The caruncle protruded 1.5 mm. between the lids, and a smooth yellowish elastic mass was seen under the epithelium. On dissecting this out, it proved to be a cyst full of caseous material, lined with flat and cuboidal cells. One similar case is on record.

The two patients that afforded material for the paper of **Duverger** and **Redslob** were young women who had noticed the sensation of a foreign body near the inner canthus. Very small cysts were found in the region usually occupied by the pinguecula. From microscopic examination and review of possible origins for such cysts (inclusion, entozooan, glandular, epithelial and lymphatic), they conclude that the process here observed of development of embryonal cells in the tissues of an adult was due to inflammatory irritation.

Blue's patient had a raised, sharply defined nodule under the bulbar conjunctiva. It had been noted for twenty months, with no increase in size recently. It was considered probably a *benign neoplasm.* **Neame** showed a case of *cyst* probably of one of Krause's glands, tho it was in the lower fornix. It had been present for fifteen years.

A case of *lymphangioma* is reported by **Franke.** The upper lid was swollen, swelling being more marked in the upper fold. The follicles near the tarsus were hypertrophied. Fragments removed by curetting showed the structure of lymphangiomata. The swelling disappeared after X-ray treatment.

Lymphoma was the pathologic diagnosis in a case of **Meyer's.** A woman of 77 had noted swelling under the right upper lid for seven years, increasing for the past year. A smooth tumor the size of a plum was removed from the upper fold. A smaller but similar one, was found in the left upper fold. As the blood picture was normal and there was no evidence of lues or tuberculosis, the growth was considered a hyperplasia of the subconjunctival lymphoid tissue. There was no recurrence after one year. A similar condition is described by **Bedell,** in which the nodules involved the ocular conjunctiva. A reddish growth, elevated about 5mm., almost surrounded the upper half of the cornea. It was subconjunctival and adherent to the globe. The thermophore had no effect. Sections of a small portion showed it to be a *lymphoma,* and the whole growth was removed. Negative cultures and animal inoculation excluded tuberculosis or other infections as a cause. No report of a similar case could be found.

Lamb reported in detail the pathologic findings in three cases *of nevus.* In one the growth was at the limbus, encroaching on the cornea, and part of it was deeply pigmented. This part was composed of nevus cells, and in one place the basal epithelium was apparently being transformed to nevus cells.

The second case involved the caruncle and was composed of nevus cells, some arranged in alveoli. The nevus cells were in contact with epithelium and seemed to be derived from epithelial cells. In the third case the growth had been present at the limbus since childhood, assuming a cystic character. Sections showed that the cysts were probably formed by degeneration of the central cells in alveoli formed of nevus cells. Only a small amount of pigment was found in some cells in the last two cases. He concludes that the term "nevus" should be reserved for tumors made up chiefly of nevus cells, which are distinctly characterized by being large round or oval cells with scanty cytoplasm and large, dark staining nuclei.

Rossi reviews the literature of simple angioma of the conjunctiva since Castelain's article in 1907. Fifty-three cases had been reported before that article, and the author has collected five cases since. His case was a man of thirty-six who had noticed a growth of the right eye for two months, which was increasing. Three millimeters from the temporal limbus of the right eye was an oval nodule, 1 x 1/2 cm. in dimensions. It was reddish, covered by intact epithelium and movable on the skin. Lacrimation and photophobia were marked, and there were enlarged vessels extending onto the nodule. There was marked deep congestion of all the vessels of the bulbar conjunctiva. The nodule was excised and had shown no recurrence. The sections showed the typical picture of a mass of dilated vessels just under the conjunctival epithelium. The mass was surrounded by connective tissue and infiltrated by lymphoyctes and plasma cells. A few large round cells were found in the infiltration. In comparing this with other cases, the author states that most of the cases are of the cavernous type, and believes this is due to the fact that they reported for examination only after they have become quite large. Most had been noted in the interior angle. Only nine have had similar positions to that in the author's case.

Jendralski saw a soft tumor near the limbus which had developed from a pigmented spot noticed in childhood. Sections showed it to be a *cystic pigmented nevus.* Since pigment is found normally in the conjunctiva of most mammals and of the dark races, the author considers nevi as organ rests left undeveloped, instances of a sporadic atavism, and hence that they belong in the group of progonoblastomata.

MALIGNANT TUMORS.—*Carcinoma of the caruncle* is described by **Duckworth.** The growth had appeared four months before, and when first seen, measured 3 1/2 by 4 mm. It covered the nasal part of the sclera and was adherent to both lid borders at the inner angle. The submaxillary glands were apparently involved. Enucleation being refused, the growth was excised freely and the site cauterized. Five daily applications of radium were given, but the patient died in 40 days, probably of lung metastasis. Sections of the original growth showed basal cell carcinoma.

Strader and **Beck** showed a case with a nodule under the ocular conjunctiva, present for one year. Exenteration of the orbit and radiotherapy were advised. The growth was considered an *epithelioma* of the conjunctiva.

Lopez, Chavarria and **Ribon** removed a red nodule from the ocular conjunctiva. Enucleation had been refused. Four months later the growth recurred, involving the muscles and palpebral conjunctiva. The eye with the lacrimal gland was enucleated, and sections showed *epithelioma,* with some melanoblastic cells present.

Francis gives a summary of the opinions of pathologists and also clinical experience which permit the following deductions: (1) That *epithelioma at the limbus* is a relatively superficial process, with but slight tendency to invade the deeper structures, because of anatomic barriers. (2) it is relatively nonmalignant in type, of slow growth and shows long periods of rest. (3) There is no tendency to involvement of neighboring lymph glands. The method of operation which was employed in the three cases reported is described. In these cases recovery without recurrence had taken place.

Sarcoma is described by **Moller** in a man of 47 who had been injured two or three months before. A papillomatous tumor developed, which on removal, was found to contain a splinter of wood. Enlargement of the preauricular glands subsided under X-ray treatment, but multiple metastases developed elsewhere. **Neame** saw a case with swelling under the upper lid and a growth surrounding the cornea. The eye was enucleated and sections showed a round celled *leucosarcoma* extending into the globe and involving iris, choroid and ciliary body. It recurred and the orbit was eviscerated. Since the sight was reported as good until seven months after the external growth was noted, this was considered as the primary tumor. **Aubret** reports the development of a tumor, the size of a small walnut, at the site of a pterygium which had been removed and cauterized several times in the past two years. It was excised, with the caruncle and semilunar fold, and the raw area of cornea left was covered by a flap. Sections showed what was evidently a sarcoma with giant cells, but including also mucous cells embedded in a homogeneous matrix. It was considered a *sarcoma,* epitheliosarcoma, or granulation tissue with malignant degeneration.

Hudson reports a case with a fleshy tumor under the bulbar conjunctiva, showing some pigment at the periphery. The vessels were ligated and the growth excised. It recurred in 3 1/2 months and was removed by cautery incision. The first growth showed on sections a typical nevoid structure with nevus cells invading the surrounding tissue. The second tumor proved to be a *sarcoma* made up of polyhedral cells, with some pigment which was considered hematogenous.

In one of **Bedell's** cases, the nodules removed from both upper folds showed as *lymphomata* on section. They recurred, with involvement of the orbit and cervical glands and the appearance of a similar nodule on the upper lip. The patient died after four years from laryngeal spasm. Sections of the primary growths showed lymphoblasts with mitoses, and they were classed as lymphoblastoma or malignant lymphoma. In discussion, Suker mentioned two cases with similar nodules in the cul-de-sac, one of which had a recurrence but was cured by X-ray and radium.

Couce and **Poyales** describe as *pseudosarcoma* of the caruncle the case of a twelve year old child, with a tumor of the caruncle the size of a pea, preventing closure of the eye. On excision, it was found to be of inflammatory nature, with degenerative tendencies.

Benign Tumors of Cornea.—**Garraghan** reports a *papilloma* of the cornea. His patient, a man of 70, had noticed a red spot near the inner canthus which in 13 months, covered 4/5ths of the cornea, reducing vision to counting fingers. It formed a raspberry like pinkish nodule extending from the outer limbus across the inner angle. A portion proved to be papillomatous, but the growth recurred seven times after removal. Sections showed a papilloma with mild inflammatory changes. In one of **Shahan's** cases, in which sections showed a papillomatous structure, the growth disappeared from the cornea after two applications of the thermophore.

Van Lint reports a case of a woman of 46. The growth, which had been noticed a month before, was at 5 o'clock on the right cornea and looked like a pterygium. It was already 6 x 8 mm. in size and 4 mm. thick; rose colored and rather firm. It overlapped the cornea but was not adherent; but to the left of it was a yellow nodule 1 mm. in diameter in the cornea. There was no history of trauma.

Involvement of the cornea in *xeroderma pigmentosum* was observed by **Wolf** in a girl of 6, whose face and neck were covered by atypical yellowish-brown nodules. The right eye showed a white, raised growth from the limbus over the cornea including 2/3rds of the latter. In the left eye the lower ocular conjunctiva and part of the cornea was the site of a dark-brown nodule the size of a bean. The rest of the cornea was diffusely opaque. Sections of the tumor from the right eye showed rosettes of epithelial cells and some pearls, resembling an epithelioma.

A *sclero-corneal cyst* described by **Mariotti** followed injury by a stone. An adherent linear leucoma was formed at the outer part of the cornea, and at the outer part of this was a cyst the size of a cherry stone and apparently including the superficial layers of the sclera. The anterior wall was removed and the sac curetted. It contained fluid resembling the aqueous, which apparently came from a piece of iris included in the scar. A *dermoid* seen by **Shahan** showed no effect from the thermophore.

Carcinoma.—**Sattler** adds three to the seventeen previously reported cases of epibulbar carcinoma penetrating the globe. He believes the usual route is thru the corneoscleral stroma into the perichoroidal space, tho the stroma of the cornea may be penetrated from the limbus, or from the anterior surface by destruction of Bowman's membrane. In treatment, small tumors may be removed, followed by radium or X-ray, for which the technic is given. In larger tumors, simple enucleation is sufficient, unless the orbital septum has been perforated, in which case it must be completed by evisceration of the orbit.

Heckel gives his experience in two cases treated successfully with X-ray, which he considers the only justifiable method in small tumors. Only if the growth is large and protruding is it necessary to excise it with the cautery, X-ray being used after such removal. Both his cases were shown to be carcinomatous by sections of small portions. Seven and twelve exposures respectively were used in the two cases, the exposure being made over a hole in a tinfoil mask, so placed that the patient can keep the cornea moist by winking freely.

Koyanagi describes a case in which sections showed the picture of a basal cell carcinoma, and enucleation was performed. The clinical picture resembled that of corneal ulcer, the epithelium being undermined at the borders. There was no recurrence within a year, these tumors not being very prone to metastasis or recurrence. A similar flat *epithelioma* was seen by **D. Y.** and **J. P. Keith,** the whole cornea being of a milky apect. Six weeks after one severe treatment with radium, the milky color had disappeared, and after six months vision was completely restored. There was no recurrence after nine months. Two cases of epithelioma, one very extensive. were treated by **Shahan** with the thermophore, with entire recovery. This treatment rests on the fact that neoplastic cells are killed at a temperature (140 F. for one minute) insufficient to damage normal tissues.

SARCOMA of the cornea was the clinical diagnosis in **Peery's** case, a girl of 2 1/2 years, who had a nodule present on the cornea since she was six months old. The eye was enucleated and radium used. There was no recurrence after nine months. **Derby** saw a woman of 79 who had had dacryocystitis for ten years. The cornea was opaque and vascularized with a greyish red tumor on its lower part. The eye was enucleated and sections showed *melanosarcoma* of spindle cell type. Nine similar cases were found in the literature.

Teulieres reported the case of a man of 65 with impaired vision beginning 4 years previously, following a foreign body in the cornea. There was a brown rounded tumor in the lower part of the anterior chamber arising from the iris, partly in contact with the cornea which remained transparent. The eye was free from inflammation, with tension slightly increased. no pain. The eye was enucleated and microscopic examination of the tumor showed it invaded the canal of Schlemm and ciliary body. It was pigmented in parts, but largely free from pigment, and chiefly composed of small round cells.

KELOID.—**Lamb** describes as keloid of the cornea the condition observed in girl of 6, with staphyloma of each cornea from a birth infection. The left cornea was covered by an opaque white growth which projected 4 mm. forwards. Both eyes were hard and blind. The left eye was enucleated on account of irritation from the projecting mass. This was seen in sections to be composed of a thickening of the original staphyloma by very broad homogeneous bundles of connective tissue. with some fixed connective tissue cells between them, and a few capillaries. In the middle the posterior layers had become necrotic. The author has sections of two other eyes showing similar thickening of an old staphyloma. Another case was a similar prominent scar. Review of the literature shows these cases to be very rarely reported.

Licsko summarizes the *epibulbar tumors* seen at the Budapest Eye Clinic No. 1 for the past fifteen years. Of 74 cases seen, 66 were carcinomata and 8 sarcomata. The squamous cell epitheliomas were more malignant than the basal celled type, recurred more often and involved cornea and sclera. The basal celled type were usually at the limbus. The sarcomata arose in the subconjunctival tissue and were always malignant.

Poyales and **Munoz Urra** examined the globe in a case of *epithelioma* of the limbus. Sections showed a vegetation on a short pedicle which arose from the limbus and a part of the cornea. Some hemorrhages were present about it. The substantia propria was slightly infiltrated at the base of the tumor. The subconjunctival tissue and the sclera down to the canal of the Schlemm was infiltrated with tumor cells. The tumor consisted of large epithelial cells with numerous mitoses. The authors believe enucleation to be the only safe procedure in epithelioma of the cornea. (See p. 505.)

Oyenard reports the case of a man of 50, with a tumor 1 x 1 1/2 cm., in size at the lower limbus. It had existed for 1 1/2 years. It was removed and radium applied, with primary healing. Sections showed a large round celled *melanosarcoma.* There had been no preexisting nevus.

TUMORS OF SCLERA.—**Goulden** and **Whiting** report *epithelial cysts* of the sclera in a girl of 16, subsequent to a double tenotomy with advancement of both external recti. Two months after operation, swellings appeared above and below the cornea, increasing slowly in size. They were pearly white, firm, adherent to the sclera, and evidently cystic. Their anterior walls were removed and the conjunctiva drawn over them. Sections showed the inner wall to be lined with squamous epithelium, which was covered by two layers of tissue resembling that of the sclera.

BENIGN TUMORS OF IRIS.—Cysts of the iris were treated by **Jendralski** with X-ray. In a large *traumatic cyst,* enucleation was necessary six days after treatment on account of sympathetic ophthalmia. A splinter was found, with some epithelial cells which it had carried into the interior of the eye. One smaller cyst decreased greatly in size after treatment by mesothorium. **Cruise** showed a case in which the cyst had caused atrophy of the iris, leaving only its posterior layers back of the cyst. There was no history of injury, and he believed it to be a retention cyst, formed in an occluded crypt.

In **Butler's** case, the globular cyst filled the upper part of the anterior chamber, extending halfway across the pupil. Three weeks later, pain developed and the cornea was steamy, but the tension was not high. The cyst was flattened and partly covered by blood. It was pulled out of a keratome incision and cut off. Sections showed its walls to be composed of two to three layers of epithelium like that of the conjunctiva, so that it was evidently an implantation cyst, tho there was no history of trauma. Five months later the anterior chamber was abolished, the iris pushed forward and enucleation was advised. In **Fleming's** case an injury with perforation at the limbus had occurred 18 months before, with adherent iris. A nodule was present in the anterior chamber which showed no increase in size during six months.

Koch saw what was evidently a *congenital cyst,* as the parents had noted a grey spot on the iris nine days after birth. When seen at the age of nine months, the cornea was larger than that of the other eye, with a diffuse opacity in the nasal half. The lower inner part of the iris was pushed back by a cyst, and the iris showed many new vessels. A piece of iris including the cyst was excised, with good result. Sections showed the anterior wall made of two to three layers of cubical epithelium; while the posterior wall was of high cylindric epithelium resting on cubical basal layers. Origin from a supernumerary lens germ seemed the most probable one.

A rare case of *spontaneous intraepithelial cyst* is described by **Bliedung**; there having been only eight such cases previously reported. His patient, a woman of 53, had bilateral cataracts and cysts. The latter could be seen to originate behind the border of the pupil, pressing the iris forward and extending over the pupil. The cataracts were extracted, iridectomy being done and as much as possible of each cyst removed. Eleven months later, two small brown cysts had appeared at the upper pupillary border, one being continuous with the pigment epithelium. The left eye showed no recurrence. Sections of the portion removed at the extraction from the left eye showed the cyst to be formed by proliferation of the pigment epithelium, similar to that producing the flocculi seen in animals. It probably had some relation to the sinus annularis.

Vogt describes the appearance of *cysts of the pigment border* as seen by the slit lamp, four cases having been seen in one year. They are brown and slightly transparent, the grains of pigment being visible. Most are on the border, but one case was seen with several small cysts in each eye, all of which were entirely on the posterior surface. They are isolated or in groups, or two may be fused, with a septum between. All four cases had simple or chronic glaucoma and had received miotics. In one case the cysts were seen to develop during two months; in another they developed, remained for three months and disappeared, as if by spontaneous rupture. They may possibly be the result of excessive secretion from the miotics used.

ANGIOMA.—The case reported by **Bleisch** was that of a patient 67 years old, in whose eye the tumor had remained unaltered for ten years. It was situated on the lower outer segment of the iris, encroaching upon the anterior chamber, and consisted of tortuous blood vessels with a whitish supporting tissue.

MELANOMA was seen by **Ridley** in a man of 49. The mass measured 3x15 mm. and was situated in the chamber angle. It had been present since birth with no increase in size. Two similar growths were seen in adults, both also present since childhood, and apparently stationary. Enucleation had been advised by others in two of the cases, but the author believes they are usually benign.

Seefelder's case showed a tumor in the anterior chamber from the ciliary border to the pupil. Its surface was irregular, and part of the growth was dark brown, the rest red. It was removed by iris forceps and a spoon, and vision remained 6/6. Sections showed a covering of pigmented epithelium portion composed of vascular connective tissue. It appears to be in nature somewhere between a *melanoma* and a *gliosis* of the retinal epithelium.

The picture of *melanoma of the choroid* is illustrated by two cases reported by **v. Szily.** One showed an oval raised pigmented spot about 2 P. D., in diameter. It was in the macular region, but the macula could be seen over it, and vision was normal. It remained the same during two years of observation. The second case showed granular pigmented areas resembling "grouped pigmentation of the retina." The eye was removed, however, because of an epibulbar carcinoma, and sections showed that the retina was not involved. The choroid was two to three times its normal thickness, and nests of strongly pigmented chromatophores were seen in the outer layers only. There was no evidence of beginning malignant change. The histologic picture was similar to Fuchs' six cases, but this is the first reported case in which both a clinical and histologic picture was obtained.

MALIGNANT TUMORS OF CHOROID. MELANOSARCOMA.—**Pfingst** and **Graves** saw two brothers with eye tumors. Enucleation and sections showed spindle celled *melanosarcoma* in both. Such a family history is very rare in the literature. **Johnston** reports three cases of melanosarcoma in which enucleation was done. One died of liver metastasis in six months, one of pneumonia after three years, and one is well after two years, tho two nodules were present outside the sclera. In **Levy's** case simple detachment was first diagnosed because transillumination was clear. Ten months later, however, a dark shadow was seen, and tho tension was normal the eye was enucleated. The vitreous was half filled with what proved to be a round and polymorphous celled *sarcoma,* only a small part of which was pigmented.

A. Fuchs examined an eye which was enucleated after a cataract extraction because of sympathetic inflammation in the other eye. The typical changes of *sympathetic ophthalmia* were found, nodules of round and epithelioid cells in the choroid and ciliary body. Besides this, a small spindle celled melanosarcoma was present just back of the ora serrata. It was only 0.6 mm. thick, affecting the deeper layers only, but shown to be a sarcoma by its extension thru the sclera around a vein. **Redaelli** removed an eye in which, after traumatic *panophthalmitis* had subsided, irritation continued. He found a round and spindle celled melanosarcoma infiltrating the whole uveal tract. He believed that it had been present before the injury, and that the infection was responsible for its extensive diffusion.

In one of the cases reported by **May** and **Williamson-Noble**, there was evidence of secondary glaucoma. The eye was red and painful and the lens was displaced, obliterating the anterior chamber. At enucleation a melanosarcoma the size of a pea was found. As the nerve seemed involved, the orbit was eviscerated, with no recurrence at time of report. **Velhagen** reports a case with severe iridocyclitis, and later a destructive ulcer of the cornea. At enucleation, a melanosarcoma was seen invading the retina and nerve. The orbit was eviscerated, and the patient is apparently well after eighteen months.

Ballantyne's case showed the value of puncture in diagnosis of subretinal tumors, since in both cases transillumination was questionable. In one case, at scleral puncture over the detachment only a few drops of glairy fluid escaped, with no effect on the detachment. A discission needle was then entered opposite to the detachment, carried down to it, under ophthalmoscopic observation, and into the detached retina. A little blood escaped, and a resistant mass was felt. In this case and a similar one, enucleation disclosed a sarcoma.

On the basis of an examination of 69 sarcomata of the uveal tract, **Gilbert** discusses their histology. Fifty-nine were primary in the choroid, one in the iris and 9 in the ciliary body. All are melanoblastic tumors, arising from chromatophores. Those formed of spindle cells with large nuclei were most frequent; but differences in cell form and the presence or absence of pigment indicates only their stage of embryologic development. The tumor arises from the stroma of the choroid, and the pigment epithelium plays no part.

Weidler reports a case of melanosarcoma discovered in routine refraction. **Edmond** saw a tumor develop from a small pea sized nodule at the edge of the disc to one which completely hid the disc eight days later. Melanosarcoma was found at enucleation. **Curtin** saw a typical melanosarcoma with tension of 45, in which the tumor had involved the ciliary body and iris. He also reports a *leucosarcoma* in a case which came to enucleation after four months of radium treatment. The growth was a spindle celled sarcoma with no pigment. **Mangin's** case was a typical melanosarcoma with rise of tension, but cataract prevented a view of the growth till after enucleation.

Argañaraz reports two cases of *flat sarcoma*, the only ones ever seen in his clinic. In both cases a shell of new growth extended over half the circumference of the choroid. One case was blind in the eye over a year before any other symptoms developed. He emphasizes the fact that in these flat growths vision is lost before rise of tension develops. Thirty-five choroidal sarcomata of the usual type have been seen in the clinic at Buenos Ayres in 35 years.

CARCINOMA.—**Macmillan** reports *metastatic carcinoma* of the choroid in a woman with general carcinomatosis, 18 months after breast amputation. She died in one month, with visceral and dural metastasis. A large medullary carcinoma filled one-third of the vitreous, and was invading the retina, nerve and sclera; while a smaller growth arising from the nasal side of the choroid was apparently a second independent metastasis. **Wood** saw cases of flat neoplasm. One had noted poor vision for only six weeks, and showed a detachment. The growth was evidently a metastasis from a primary focus, probably of *epithelioma,* in the antrum, the lower jaw and cervical glands being also affected. A flat growth was found, infiltrating the sclera all around. The second case had a blind glaucomatous eye. At enucleation a flat growth occupied the outer half of the fundus, which Collins considered probably a secondary *alveolar carcinoma,* tho it was first called a sarcoma.

Merigot de Treigny reports two cases of metastatic *carcinoma,* one occurring ten months after breast amputation, and one in a subject of inoperable carcinoma of the breast. **Shioji** gives the outcome of a case reported two years before (See Oph. Lit., 1921, p. 435) as metastatic *carcinoma* of an eye from a focus in the breast. Two months after enucleation, vision failed in the other eye, which developed a complete detachment. Postmortem showed metastasis in most organs, and in the choroid, ciliary body, optic nerve and ciliary nerves of the remaining eye.

TUMORS OF CILIARY BODY.—**Märtens** reports a case of *carcinoma, primary* in the ciliary body. His patient, a woman of 46, had noted irritability of R. E., at times for two years. The past few months there had been attacks of severe pain at intervals of one to two weeks. The eye was blind, inflamed and slightly shrunken. A yellowish reflex was seen thru the cornea. At enucleation, the nerve was seen to be much thickened by a nonpigmented mass. As an epithelial tumor was reported by the pathologist, it was considered probably a metastasis, so the orbit was not eviscerated, only the stump of the nerve removed, its posterior end being also thickened. After six months there was no orbital recurrence, but the patient developed paralysis of the tongue and pharynx and the left eye became blind.

Death from endocarditis occurred seven months after enucleation, and postmortem showed extension of the tumor to the base of the brain, including the left optic nerve. No trace of carcinoma was found elsewhere in the body. Sections showed the eye to be filled with a mass of confluent nodules, which had replaced the lens and iris. All stages of development of the tumor were seen, including bony placques which had replaced the oldest necrotic portions at the periphery. Origin from the ciliary body was shown by proliferations of the ciliary epithelium, showing transitions of tumor formation. It probably arose from several points of proliferation. Two similar cases have been reported, but this is the first one in which absence of malignancy elsewhere could be proved by complete postmortem.

Adenoma of a ciliary process was seen in the eye examined by **Fuchs,** in which sarcoma of the choroid and sympathetic ophthalmia were also present.

TUMORS OF LACRIMAL GLAND.—**Lane** completely reviews the subject of tumors of the lacrimal gland, and reports a case of *mixed tumor.* Of 229 cases of tumor found in the literature, about half are mixed tumors. Her case was a woman of 25, who had noticed a swelling of the left eye for three months. Tenderness and exophthalmos were present, and on everting the lid a mass presented which was adherent to the bone. Operation was refused, but the patient returned ten months later with a slight diminution of vision and increase in the size of the tumor. It was removed, with no recurrence in five years. Sections showed a part composed of epithelial tissue, with pearls, while there was much connective tissue showing hyalin and myxomatous change. A bibliography of all reports since 1901 is appended.

Maxwell reports bilateral *lymphoma* of the lacrimal gland in an old man. The parotid, submaxillary, preauricular and inguinal glands were also enlarged, while there was no blood change suggestive of leukemia or any other constitutional cause for the swellings.

Epithelioma was observed by **Tourneux** and **Lefebre** in an old man whose eye was enucleated on account of orbital tumor, which had produced exophthalmos and corneal ulceration.

Sections of the mass showed epithelioma originating in the lacrimal gland. **Crawley** reports a girl of 20, in whom a tumor of the lacrimal gland was removed one year after it was first noticed. It recurred in a few months and was removed more extensively, showing both times a tendency to involve the bony orbit. From the sections it appeared to be endothelial in origin, but was of malignant nature. **Beauvieux** and **Pesme** saw two cases of *adenoepithelioma.* The first was in a girl of 23, and recurred five times after removal. After the last removal the patient was reported to have symptoms of metastasis into the brain. The growth was found to be composed of polymorphous tubules of cylindric epithelium. Their second patient had noted swelling under the brow for two months, with diplopia on looking up. A smooth tumor, the size of a pigeon's egg, was removed, which resembled the preceding in structure. There was no recurrence after eight years.

The same authors saw a boy of 8 with a swelling under the brow for three months. A growth the size of an almond was removed, including the lacrimal gland. At the periphery of the nodule was the tissue of the gland, crowded against the capsule, while the center was occupied by a round celled neoplasm showing many mitoses. These cells could be seen between the remaining gland cells. The diagnosis was *embryonal round celled sarcoma.*

EPITHELIOMA OF THE LACRIMAL SAC was reported by **Posey**, in a man of 74. He apparently had a mucocele with swelling over the sac. The sac was extirpated, a mass the size of a horse chestnut being removed. Sections showed the mucosa to be much thickened, with polypoid vegetations projecting into the lumen. The walls were the seat of a tubular carcinoma. Radium was used after removal, and there has been no recurrence in two years. The author believes this to be the thirteenth case on record.

TUMORS OF OPTIC NERVE.—**Ginsberg** saw a case of bronchial *carcinoma* which developed metastases into both optic nerves, producing complete blindness. Metastases in the brain were also found at postmortem. The tumor, an alveolar carcinoma, was seen to have entered the nerves from their sheaths.

Bride reports the case of a child 2 1/2 years old, with proptosis of one eye for several months, and choked disc. Enucleation showed a *fibroma* replacing most of the nerve, apparently arising from the connective tissue of the pia mater. Tho the tumor could not be completely removed, there has been no recurrence after a year. **Scheerer** saw four such cases, and by special staining showed the growths to be made up largely of glia cells and fibrils. He has seen only one case of true *endothelioma,* in which no glia cells could be found. **Rochon-Duvigneaud** believes the globe can often be saved in these cases, without a Krönlein, by making long skin incisions. The Krönlein should be reserved for the few cases in which additional working space is found necessary, after an attempt by the other method has been made.

Dandy describes two interesting cases of *prechiasmal intracranial tumor.* Tho the condition has been seen at postmortem, no previous cases have been diagnosed during life, and none have been found at operation. His first case was a girl of 13, who had short attacks of vomiting and diplopia, six and three years before, with three similar attacks in the previous three years. Vision had failed in the right eye, and she now showed a convergent squint. Just before coming, vision had failed in the remaining eye to 8/200. Both discs were pale. There was paralysis of several ocular muscles, and bilateral ptosis. There was no indication of temporal hemianopsia.

At operation, to explore the region of the sphenoidal fissure, two separate tumors were found, one of which surrounded each nerve like a ring, extending forward toward the optic foramen. The right tumor was removed, and as much as possible of the left one. Vision increased in two weeks to 20/200 L. E., while there was no return of vision in R. E. Sections showed dural endothelioma. The ocular palsies were probably due to a collection of fluid around the tumors.

In the second case, there were no symptoms of intracranial growth except loss of vision, and the diagnosis was made by exclusion. The patient was a boy of 8 years, in whom steady loss of vision had progressed to R. E. = counting fingers, and L. E. = 20/200, when first seen by the author. There were no muscle palsies, and the X-ray report was negative. During the next three months vision failed to R. E. = 0 and L. E. = light perception. The nerve was exposed intracranially, and a tumor of the left nerve the size of a cherry was seen, with a band holding the nerve kinked against it. The band was cut, but the tumor could not be removed. Vision increased in two weeks to R. E. = 20/70 and L. E. = 20/20, some improvement continuing after six months. The tumor probably arose from the dura at its reflection at the optic foramen.

The author concludes that, since about 40% of orbital tumors extend into the cranium, all optic nerve tumors should be approached intracranially, when a bone flap from the roof of the orbit can be made if necessary.

Verhoeff presents a classical paper on the histology of *primary intraneural tumors,* on the basis of sections in eleven cases. He would classify optic nerve tumors into intra- and extraneural, according to their origin. His specimens were from typical clinical cases of tumor. One showed gliomatous involvement of the optic disc and retina, with prepapillary cysts whose development was observed ophthalmoscopically. An early form of the same condition was seen in another case. There has been only one previous, incomplete report of a similar condition. Mallory's neuroglia stain showed all the tumors to be composed chiefly of neuroglia, which appeared in three forms: 1. Finely reticulated—fine fibrils in the interspaces of a delicate cell reticulum containing small round or oval nuclei. 2. Coarsely reticulated—showing marked vacuolization of protoplasm, giving an appearance similar to myxoma. 3. Spindle cell or coarsely fibrillated—coarse glia fibrils between which are glia cells.

No tumor showed any tendency of its cells to become free and infiltrate surrounding tissue, but all grew by proliferation of the neighboring glia, indicating the presence of some stimulating factor or the absence of an inhibitory factor. Verhoeff believes they are really congenital in origin and due to an abnormal development of the glia. In his cases there were no recurrences, tho most were incompletely removed. These are the only primary intracranial tumors of the optic nerve described, and are true gliomata.

BENIGN TUMORS OF RETINA.—**Monbrun** examined the eye of a 14 year old boy, which had shown a detached retina and retinal hemorrhages. Clumps of round cells were present in the ciliary region, with some giant cells and areas of pigment. There were deposits of cholesterin and fatty substances. The process seemed to start from the external layers of the retina, and tho probably not a new growth, was classed as a *cholesteatoma.*

Van der Hoeve describes the ocular tumors seen in *tuberous brain sclerosis.* He describes the case of a girl of 17 with epileptic seizures and other signs of brain tumor. The right optic nerve was covered by a yellowish-white tumor about 2 P. D. in diameter, part of which had a sago appearance. There were several other flat tumors in the fundi of both eyes. During observation some of the tumors disappeared, and parts would become free in the vitreous. Vitreous opacities increased, and vision decreased to 3/100 (R. E.). This eye was enucleated. Five more cases were seen, all showing tumors in the fundus, and the author thinks this ophthalmoscopic finding may be of great value in the early diagnosis of cases.

Brandt reports three cases of *angiomatosis retinae,* with sections in two, and sections of another, the original case of von Hippel. This patient, first reported in 1895, came to autopsy in 1917, showing tumors of the brain, cord and other organs which resembled hypernephroma, tho no primary hypernephroma could be found. A son of this man showed a similar ocular lesion, and the eye was enucleated. The other eye remains unaffected five years later. Another case had been blind in one eye for nine years, and had shown similar changes in the other for three years. He died of brain tumor. The third case showed a typical picture, and the eye was enucleated at once. Forty-two cases have been reported, of which four have died of brain tumor. Sections showed that the angiomatous part of the growth was intimately mingled with areas composed of strands and masses of cells. The growths are apparently *endotheliomata,* with a preference for the brain and meninges.

Rea reports a case of *angioma* with one eye almost blind. A large white mass was seen over the macular area, and smaller areas scattered over the fundus, the nodules raising the retina over them. A large vein leads below the disc to a mass of anastomotic vessels.

Gonin discusses the relation of *retinal cysts* to detachment of the retina. He believes cysts may form spontaneously by retraction of the vitreous, when the outer layers of the retina are held in place by the scars of an old inflammatory process. He saw one patient with a cyst 6 P. D., in diameter, which projected 18 diopters into the vitreous. It was punctured under direct observation, and nothing suggestive of a cysticercus cyst was seen. It refilled in a few days, showing more elevation of the retina around it.

Fuchs gives a detailed report on the examination of 99 eyes with cysts of the retina. These are usually found only at pathologic examination, as they are too small to be diagnosed clinically, and have no effect on vision. They are not true cysts lined with epithelium, but simply spaces in the retinal tissue filled with fluid. All such collections of fluid which were thicker than the retina, or which rose above its level were called cysts. Folds in the retina filled with fluid he calls pseudocysts. True cysts are formed by degeneration of areas of retina, leaving spaces in which fluid collects. They occurred most often in eyes with detachment, (70 eyes), but also fairly often in glaucomatous eyes without detachment (20 eyes). Five groups of cysts are described, according to their mode of formation.

GLIOMA.—**Verhoeff** reports what he believes to be the third case of *glioma* to be successfully treated by X-ray. He enucleated the right eye of a 17 months old boy, which had an advanced glioma, operation being followed by five X-ray treatments. Five months later a swelling 4 P. D. in diameter was seen in the left eye, with two smaller whitish areas. X-ray was used and after three years the swelling had become flat, greyish and translucent, the smaller areas having disappeared. Vision is about 20/30, and the media are unaffected by treatment. The importance of examining the second eye at the time of enucleation, so that X-ray may be used early, is emphasized.

Jacoby reports good effect in one of three cases of *glioma* from X-ray treatment, the others being unaffected. **Siegrist** mentions a recent examination of the case reported by Axenfeld in 1918. The condition had remained stationary, with preservation of normal vision, but Siegrist is inclined to doubt whether the growth in the second eye was a glioma. **Poyales** and **Pajares** treated both eyes in a case of bilateral glioma, with radium. They report decrease in size of the tumor in both eyes, with retrogression of the newly formed blood vessels. The case was still under treatment.

Meisner describes a case in which the iris showed greyish nodules, greatly resembling those of tuberculous iritis. Tuberculin treatment had no effect, and enucleation after six months showed glioma, with involvement of the iris. The posterior end of the nerve was free, and there was no recurrence after two years. The differential diagnosis of glioma and ocular *tuberculosis,* is the subject of a paper by **Sijpkens.**

Chance reports the final result reached in the case in which radium plugs had been used for recurrence in the orbit. (See Y. B. 1921.) The child is well and has had no further recurrence. **Knapp** saw a child with a granulating mass presenting thru the cornea, suggesting a perforation after panophthalmitis. Glioma was found at enucleation. **Aubineau** and **Opin** report a similar case, which was treated as metastatic iridocyclitis. Later the globe increased in size, and at enucleation two masses were found in the ciliary body extending into the cornea and iris, which proved to be gliomatous.

Ellett saw a case of fairly advanced bilateral glioma, in which enucleation was refused and radium was being tried. **Bernatz** reports a case of glioma in a man of 53, with a 4+ Wassermann. Vision in the affected eye was 20/100 at first, with a detachment up and in. Four months later vision failed suddenly, and a month later symptoms of secondary glaucoma set in. The eye was enucleated, and the pathologist reported glioma of the nasal portion of the retina with metastases in and around the nerve. **Palacios** reports glioma in a girl of 3 with recurrence in the orbit after enucleation. In **Key's** case, exenteration of the orbit was refused after examination of the cut end of the nerve showed extension. Two months later a recurrent mass was exenterated, but six months later further recurrence, involving the whole side of the face and neck, had reduced the child to a moribund state.

Moulton saw an early glioma in an eye that had begun to squint two months before. Sections of the nerve at enucleation showed no extension, but radium was used in the orbit and there has been no recurrence after one year. The importance of examining any squinting eye in a child is brought out. **Van Duyse** examined a large retinal cyst, which made up almost the whole of a microphthalmic eye. It showed a gliomatous transformation in sections, and recurred in two months, when the recurrent subconjunctival mass was removed. The author explains the case as due to proliferation of retinal tissue which had escaped from the fetal cleft.

Pi reports retinal glioma in a child of three years, in whom both eyes were affected. The child died four months after Pi first saw her.

BENIGN TUMORS OF ORBIT.—**Lewis** saw a *dermoid* cyst apparently replacing one eye in a young adult. A yellowish brown tumor was seen between the lids, on a pedicle. The surface of this showed some pigment, which may have been the remains of the iris. Aside from this, there was no globe in the orbit. **Black** showed a patient with a hard round nodule just outside of the inner canthus. It was thought probably a *dermoid* or a *cyst* from the ethmoid cells.

Betti reports a bony tumor, probably an *exostosis,* in a woman of 36, who had suffered a fractured nose in childhood. For 15 months she had noted swelling in the inner part of the orbit, with recently severe pain. A hard, conical, immovable mass was felt, which proved at operation to arise from the ethmoid bone, and to be composed of true bone.

W. C. and **W. M. Bane** showed a woman who had had pain in one eye for four weeks. Below the caruncle was a round pea sized nodule, hard and immovable. It was evidently continuous with a mass arising from the cartilaginous septum. It was operated upon by the nasal route, when the growth was seen to have filled the anterior ethmoid cells and perforated the wall of the orbit. Sections showed *enchondroma.*

Lawson and **Neame** report what is apparently a true *neuroma* of the orbit. A woman with the clinical picture of optic nerve tumor, (proptosis, choked disc) was operated upon. When the eye was enucleated, a tumor 25 x 18 x 16 mm., in size was found free in the orbit above the nerve, connected to it only by loose fibrous tissue. It was encapsulated, and composed of long fibers with oval nuclei. The fibers were nonmedullated, hence it may be be classed as a *neuroma amyelinicum,* possibly arising from the frontal branch of the ophthalmic nerve.

Pascheff saw a man of 62, who had received a cut on the brow from a shovel 27 years before, which had apparently healed promptly. Thirteen years later, small abscesses appeared which opened and healed. They recurred six years later, with thickening of the brow, proptosis, and fistulae at the external rim of the orbit, which extended to the bone. A deep mass was palpable in the outer part of the orbit. A thread like organism was obtained on culture, and healing was complete after 2 1/2 months of K. I. treatment. Two years later a new nodule appeared on the temple. This was removed and found to erode the wall of the orbit and extended to the optic foramen. Sections showed fibrous tissue with purulent foci containing streptothrix actinomyces. From animal experiments, this was believed to be close to *streptothrix farsinici bovis,* which has probably never been described in man. **Roy** reports a case of *tuberculoma* of the orbit, which showed no symptoms two years after the evisceration of the orbit. **Davis** reports *tuberculoma* of the malar recess and floor of the orbit. Swelling below the eye had been noted for nine months and the left antrum was opaque. At operation, a mass was found in the floor and outer angle of the orbit invading the malar bone. It was thought to be malignant, but sections showed only inflammatory tissue with giant cells, apparently tuberculous. Healing was good.

Knapp saw a case with a mass in the orbit and a yellowish staining of the conjunctiva over it. It was removed by Krönlein operation and proved to be an *oil cyst.*

Marcotty's patient had tumors beneath the upper and lower lids of both sides producing exophthalmos and limiting motility. An excised nodule showed *aleukemic lymphadenoma,* and under mesothorium and X-ray the nodules disappeared rapidly, there being no recurrence after two years. A case of lymphoma of the orbit, still under treatment, is mentioned by **Tiscornia.**

Hydatid cyst of the orbit is reported by **l'Heureux,** two cases having been seen during 18 months in Morocco. Rollet's orbitotomy gives sufficient access to the growths, a Krönlein not being necessary. (See Parasites). **Ringel** saw a case of *pseudotumor,* in which nothing was found at operation to explain the exophthalmos, which returned to normal after operation. His other case was a *hemangioma* which came to operation.

Niosi gives a very complete report on *cystic lymphangioma.* His case was a woman of 60, with a tumor of the internal angle which had been increasing for fourteen years, until it extended up and out in the brow and pushed the eye far down and out. The visible tumor was the size of an orange. Sixty-five cc., of fluid was aspirated from the tumor, which refilled in a few days. At operation, the tumor was found to reach the apex of the orbit, but was entirely outside the muscle cone. Healing was good, with no exophthalmos and good motility but no effect on vision. Sections showed the cyst walls to be made of a connective tissue stroma, with zones of calcium deposit and some bony lamellae. There were numerous true lymph follicles, which showed in places a rarefication and separation by fissures which were becoming lined with flattened lymph cells, showing the genesis of the cysts. Only 9 similar cases are found in the literature. A bibliography and five drawings are included.

PSEUDOBLASTOMA.—The case reported by **Marbaix** and **Van Duyse** was of a girl of 11 who had a Krönlein operation for tumor of the orbit. In 6 months there was renewed swelling of the lower lid, and the right eye began to protrude. Nine months later there was limitation of movements of the eyeball, slight ptosis, projection of the eye outwards and forward. Vision was normal, but the right eye could read only with a convex lens. Reactions for syphilis and tuberculosis were negative. There was little change until nearly two years after the operation, when pain appeared in the orbit. Again a Krönlein operation was done, followed by ptosis, insensibility of the cornea, vision reduced to 0.2. A year later there was complete ptosis and after that optic atrophy and neuroparalytic keratitis. Histologic examination showed a tumor composed largely of lymphocytes. It is concluded that chronic inflammatory lymphomatosis and such tumors associated with pseudoleukemia should not be subjected to operation but to the administration of arsenicals and radiotherapy.

MALIGNANT TUMORS OF ORBIT.—**Vermes** observed for several years a patient with a swelling of the right temple, which gradually increased, the eye being pushed forward and down. It was considered an inoperable *osteosarcoma,* and was receiving radium.

Hird reports a man of 41 with iritis of the left eye, who was cachectic and had a chronic cough. The eye was congested and proptosed, with a yellowish mass in the vitreous. Postmortem showed a mass around the posterior pole of the globe extending thru its coats into the vitreous. Sections showed *hypernephroma,* and similar metastatic foci were found in the lungs and heart.

Clay and **Barker** report a tumor in the orbit of a 7 year old girl, of three months' duration, pushing the eye up and forward. There were retinal hemorrhages, the nerve was pale and vision was much reduced. The eye was enucleated and electrothermocoagulation used in the orbit, the mass then being removed, and the bony floor similarly treated. In one year the orbit had refilled with a mass.

Lymphosarcoma is described by **Hartshorne,** in the case of a 4 year old boy, which ran a course much resembling glioma. The tumor probably arose in the choroid, and was seen as a yellowish reflex in the vitreous at the age of 6 months. Enucleation was refused, and two years later the eye was transformed to a brownish mass, while the orbit was full of an immovable newgrowth. The orbit was eviscerated, and radium applied. Two months later the orbit had begun to refill, and in spite of intensive X-ray treatment, the process continued, while a cachexia set in and the child died six months later. The other eye had showed a swelling up and in from the nerve, which was believed to be a metastatic neoplasm. Sections of the orbital contents showed the globe almost replaced by a newgrowth composed of small round cells, which had extended into the orbit. It was considered to be a *lymphosarcoma.*

Bretagne, Roy and **Kostich,** saw a boy who had one eye removed a year before, for an intraocular tumor. After five months there was recurrence in the orbit, and sections of a part of this tissue showed *round cell sarcoma.* It cleared up entirely after six treatments with radium. **Rosati** reports a young adult, with a nodule in front of the lower margin of the orbit, the size of a hazel nut, pressing the globe upward. It doubled in size during two years. Operation showed a soft tumor occupying a niche in the region of the infraorbital canal, separated from the orbit by a thin bony wall. It recurred in four months, when a wider excision of surrounding tissue resulted in a cure, with no recurrence after eight years. Sections showed *spindle cell sarcoma.*

Buckley's patient, a woman of 38, had suffered pain in the upper jaw and an inflammation of L. E., for six months. A small nodule was removed from beneath the orbital roof, which was reported to be nonmalignant inflammatory tissue. Six months later the eye was proptosed, and a mass was felt on the floor of the orbit. This was removed and reported *myxosarcoma.* A third removal of two nodules, above and below the eye, four months later, resulted in cure of the exophthalmos. A ptosis operation was done later, with good result and there is no recurrence after 1 1/2 years.

O'Hea-Cussen saw a case of *sarcoma* with an unusual onset, the first sign being sudden pain in the right brow with an attack of vomiting. There was a bursting sensation and pain was relieved. The next morning the lids were much swollen, and in four days the eye was much proptosed and the cornea necrotic. The globe was enucleated, and sections of the tissue left in the orbit showed spindle cell sarcoma. The orbit was eviscerated, and there has been no sign of recurrence of metastasis in four years.

Curtin's patient noted a pain and increasing proptosis of one eye for six months. A mass was felt in the orbit, and it was eviscerated, skin flaps being drawn over the surface at the primary operation. The tumor had perforated into the nasal sinuses and middle meatus. Radium was given. There is no recurrence after two months. Sections showed a *mixed cell sarcoma,* with invasion of the globe.

Sijpkens examined a growth of the orbit, part of which was a typical *cylindroma* and part a *basal celled carcinoma,* which he believes indicates malignant change of the primary growth.

Green reports a patient who had evidently had an epithelioma of the nose 15 years before, which had healed with cancer paste. Eight years later a nodule appeared at the lower edge of the orbit, slowly increasing in size. It had broken thru into the ethmoid cells. It was removed and a radium exposure given, which produced erysipelas and perforation of the globe. The tumor was a *basal cell carcinoma.*

TREATMENT OF TUMORS.—**Martenstein** gives details of his management of tumors. In surface growths he uses both X-ray and radium or mesothorium. In pituitary tumors, he uses X-ray on eight different fields of the skull, one being rayed each day for eight successive days. The course is repeated in four and again in six to eight weeks.

SUMMARY.—From the purely pathologic point of view, the reports of **Verhoeff** on intraneural tumors of the nerve, of **Fuchs** on retinal cysts, and of **Lamb** on nevus conjunctivae are most important. Clinically, **Dandy's** exact description of prechiasmal intracranial tumors of the nerve, accessible only by a cranial exposure, adds a new chapter to our knowledge of optic nerve tumors, and offers one more possibility to be considered in cases of failing vision with no objective findings.

In the field of therapeutics, the use of X-ray and radium is coming to have a recognized field, especially as by **Heckel** in epibulbar carcinoma and in the orbit after enucleation for glioma. **Verhoeff's** report of a case in which glioma of the second eye was apparently cured by X-ray is noteworthy, as probably the third case of its kind. The use of the thermophore by **Shahan** to produce a temperature which will kill neoplastic cells without harming normal ones offers interesting possibilities. **Deutschmann's** experiments with antigerm cell serum for destruction of neoplasms are theoretically of interest, tho requiring much further clinical evidence.

Several rare conditions are reported, such as the neuroma amyelinicum of **Lawson** and **Neame,** the spontaneous intraepithelial cysts of the iris seen by **Bliedung,** and the primary carcinoma of the ciliary body described by **Märtens.**

Ocular Parasites

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This section carries the literature from October, 1921 to October, 1922. For previous references see Vol. 17, 1921 p. 444.

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DIGEST OF THE LITERATURE.

MYIASIS.—**Gabrielides** and **Guiart** have reported the case of a shepherd, who complained of itching, tearing and pain in the left eye, about thirteen hours after he had noticed what he thought to be an insect bite. There was reddening of the ocular conjunctiva below and near the inner angle. Larvae of estrus ovis were seen by use of a magnifying glass, and are described as having been active in motion, and of whitish grey color with a black anterior extremity. The conjunctival discharge, tho abundant, did not show the parasite, but microscopic examination did show the estrus ovis.

Larrouse identified the parasite in two of the three cases reported in France. The two seen by Larrouse occurred in 1921. The author states that the condition is rare and not of very great importance, and observes that estrus ovis closely resembles rhinestrus purpureus (Brauer). A differential table for purposes of identification is given and is accompanied by drawings showing the structure. Determination may be quickly made by examining the terminal hooks of the last ring, estrus possessing 20 or 22, the larva of rhinestrus 8 or 10. Most of the cases are due to rhinestrus which is widely distributed in Russia. Estrus occurs in Sicily, North Africa and the Cape Verdi region. The author appends a bibliography.

CYSTICERCUS.—**Abbott** reports a case of general infection by cysticercus cellulosae. The patient, female, was admitted to the Mental Hospital, Knowle, Fareham, suffering with melancholia, deafness in both ears and greatly reduced vision. She presented many small shot like nodules, especially on the upper right arm, which according to the patient had appeared about seven months before. Hay had examined the eyes and had reported local detachments in right eye, due to cysts beneath the retina. In the left he thought the reduced vision due to opacities in the lens.

Examination of stools for parasites was negative, but cysticercus cellulosae were recovered from a cyst excised from the arm. The patient died later from tuberculosis, and postmorten examination showed the heart and the convex surface of the brain studded with cysts. The subcutaneous tissue of the arms, thorax and abdomen was filled with cysts and the peritoneum was profusely studded with them.

Strebel reports the case of a patient, in whom subretinal cysticercus was discovered ophthalmoscopically, and proven by microscopic examination after the eye was enucleated.

Schwarzkopf states, that since the institution of meat inspection in Germany, cases of cysticercus have been less frequent than formerly, but that during the war, because of less strict meat inspection, the cases increased in number. Five cases of intraocular cysticercus were brought to one hospital after the beginning of the war. The author reports that in all five of these cases the worms were removed without loss of the eyes; and that all of the parasites were either in, or beneath the retina. He reports a case of his own and states that medical therapy is permissible only in exceptional cases.

HYDATID CYST.—**Du Toit** reports a case of hydatid cyst in the left orbit of a male, aged 33. The patient stated that he had had severe headache ten months before he presented himself to Du Toit, and that soon after the left eye had become painful. Six weeks later he noticed double vision, the eye became more prominent than its fellow, and later his vision had begun to fail in the affected eye. Examination showed the right eye normal. The left eye was markedly proptosed, was rotated slightly down and in, superduction was defective, the pupil reacted sluggishly, and vision was reduced to counting of fingers at 2 meters. The media showed no clouding, the papilla was quite swollen, the retinal veins were engorged and several old, and a few new, hemorrhages were to be seen.

Exploratory operation was declined at the time but later the patient returned and begged to have the eye excised because of the intense pain he was having. Exophthalmus was much increased and the tumor could be palpated in the left orbit. Under general anesthesia, the cyst was exposed thru an incision made over the left external rectus. The cyst was ruptured and a straw colored fluid escaped. The cavity was irrigated with a 1-5000 solution of perchlorid of mercury and a gauze drain was inserted. Recovery was complete excepting loss of vision. Section of the cyst wall proved it to be hydatid.

Damel and **Marque** have reported two cases of hydatid cyst of the orbit. The first patient, a girl of six years, had all of her symptoms arise within a period of six months prior to the time she presented herself for examination. There were ptosis, convergent strabismus and exophthalmus, which was reducible upon making pressure. The vision was low, there was tenderness to touch, pupils were unequal and all of the extrinsic muscles of the affected eye were paralyzed. A marked papillitis was observed. At the time the patient entered the hospital a provisional diagnosis of orbital *sarcoma* was made. Blood examination showed hemoglobin 90%, polymorphonuclears 20%, staining index 1. The seroreaction for hydatid antibodies was slightly positive. X-ray showed a shadow occupying all of the fundus of the orbit.

L'Heureux reports two cases of hydatid cyst of the orbital cavity, a condition rarely met with in France, but seen much more frequently in Morocco. The cases are described in detail, and the writer is convinced that the orbitotomy of Rollet with conservation of the globe is the best operation, giving sufficient room for enucleation of the tumors, avoiding the often mutilating operation of Krönlein. He counsels against enucleation of the eye with exenteration of the orbit.

Phokas lays emphasis on the differentiation between medical and surgical exophthalmos, the former being bilateral, while the latter is almost always unilateral. His patient had suffered for 12 years after being thrown from a horse, and soon after he noticed the left eye becoming more prominent. The possibility of a neoplasm was not to be lost sight of, however. Close examination revealed a lateral exophthalmos such as commonly occurs with swelling of the orbital contents; visual impairment, sluggish pupil; tic of the facial muscles of the left side as well as of the left arm; evidence of pressure on nerve roots, and the author suspected a benign neoplasm, since the patient altho suffering for 12 years, was apparently in good health. A Krönlein operation confirmed the diagnosis of echinococcus cyst of the orbit. Operation was followed by improvement in his condition, disappearance of the exophthalmos and restoration of vision.

At operation a hydatid cyst was removed from the outer posterior portion of the orbit, following which normal vision was regained. Function of the external eye muscles returned, but a slight convergent strabismus remained. The second case reported by these authors is of a woman of twenty-one years, whose symptoms developed within a period of twenty days. The tumor could be felt in the orbit and was accurately diagnosed by means of exploratory puncture. The cyst was excised, and within five days all symptoms had subsided.

Tiscornia discovered a hydatid cyst of the orbit in a rare location. The cyst was deeply placed near the vertex of the orbit, and had to be removed by means of the Kroenlein operation. There were exophthalmus and marked loss of vision. In his conclusion the author states that this is the first case, of which he knows, in which the Kroenlein operation had to be used. At time of the first examination, the vision of the involved eye, left, was counting of fingers at 3 meters, and after operation it improved to 20/40.

Dévé states that intraocular cysts may be due to either echinococcus or to cysticercus, and that intraocular hydatid cysts are of rare occurrence. He tabulates 269 cases of intraocular cysticercus collected by Vosgeinin, in which series 112 were found in the retina, 26 in the anterior chamber, 7 in the iris, 2 in the crystalline lens, and 2 in the cornea. The author makes the statement that only 6 cases of hydatid cyst of the eyes has been reported by Demaria. He refers to cases reported by Gescheidt in 1833, by Griffith in 1901, by Wood in 1906, Scholtz in 1906, and by himself in 1916, each of them reporting one case. He reports his own experiment, in which he inoculated a rabbit in the central end of the left carotid, after ligating the opposite carotid, with hydatid liquid containing echinococcic sand from the cysts of the sheep. The animal remained normal for a period of five months, at the end of which time the signs of cerebral tumor were seen. An autopsy, done five and a half months after inoculation, showed a hydatid cyst the size of a walnut occupying the posterior fold of the right cerebral hemisphere, and another cyst in the fundus of the left eye.

Filaria Loa.—**Butler** removed a specimen of filaria loa from the conjunctiva of a medical man who had become infected with the parasite about fifteen years previously. He states that the worm could be seen wriggling about beneath the conjunctiva, and describes the technic he used in the operation for its removal. He reports a similar case by De Milly in 1905, another by Petit in 1911, and still another by Brunetiere in 1913.

Charles has reported the removal of a female filaria from beneath the conjunctiva (ocular) of the right eye of a man aged 45. Sewell examined the specimen and gave a description of it, stating in addition to his description that similar specimens have been removed from about the same location by Dubini, Addario and Allesandria.

Hirsch states that thread worm is found exclusively in western Africa, that it may live in its host for many years, and may be observed in its host many years after the patient has left this locality. He records the case of a male, aged 35 years, who had been a prisoner of the British from 1907 to 1909, had lived in Kamerun, later in Samoa, and then returned to Germany.

Four years previously, a specimen of filaria loa, about 40 mm. long, had been removed from the conjunctiva of the left eye. Since 1901 filaria loa had been in evidence in various parts of the body of the patient. When seen by Hirsch he was complaining of itching and inflammation of the left eye, and a piece of thread worm about 9 mm. in length was removed from beneath the ocular conjunctiva of the left eye near the limbus. The author states that filaria loa may be imbibed with drinking water. **Das Gupta** removed a filarial cyst from the conjunctiva of a Mohammedan patient. From the cyst he recovered two living worms, each measuring 1 1/2 inches in length. The paper of **James** on filaria loa is an answer to an inquiry by Charles, and gives no new data.

RHINOSPORIDIUM.—**Wright** reports the second case thus far on record of rhinosporidium of the lacrimal sac. He refers to a first case reported by Kirkpatrick in 1916. Wright's case is that of a Moplah, who appeared to have an inflamed cystic condition of the lacrimal sac, which was tense, red and had a small sinus above, thru which purulent material escaped. The tumor is described as having been boggy to touch and could not be squeezed flat. Large masses of rhinosporidial polypi were discovered, springing from the inferior and middle turbinates of the same side of the nose. The lacrimal sac was extirpated; and is described as having consisted of a fibrous wall, from the inner surface of which were polypoid projections completely filling the lumen of the sac.

Wright was quite certain that rhinosporidium of the conjunctiva is often overlooked or mistaken. Recently, in a period of six months, during a routine examination of boys in the Civil Orphan Asylum, among whom conjunctivitis had broken out, he found 3 cases of this affection. In this same institution 91 other boys and 60 girls resided, and none of the girls were found to have rhinosporidium of the conjunctiva. The condition has not been seen, according to records, in any female in the Madras district.

The author describes the appearance of the growth by stating that some observers have thought it resembled "liver of rat," "spleen of guinea pig," "lung of mouse," and thinks that these expressions give a fair idea as to the appearance of the growth at first sight. The caruncle in old persons is frequently somewhat suggestive of rhinosporidium; the yellow follicles on the fleshy ground resembling, at first sight, the parasitic polyp. Close inspection of the little tumors show thin, yellowish edges and tiny, round whitish or yellowish elevations just beneath the epithelium. In the three cases described, there was a white eye, no photophobia, lacrimation or other symptoms. One of the patients had been outside of Madras; none had ever been to the west coast. One was thirteen and the other two were fourteen years of age. The author states that the administration of tartrated antimony drops for this condition has been successful.

TENIA SOLIUM.—**Strebel** states that the toxins of intestinal parasites, especially of the tenia, give rise to inflammation of the optic nerve, as well as to other ocular conditions, among which he mentions punctate keratitis and metastatic conjunctivitis. He states that cases of the latter sort improve upon expulsion of the parasites from the intestinal tract. He gives a case report of a woman of 28 years, who had noticed the segments of tenia solium in her stools, and who when seen by him presented papillitis of the left eye, followed in seven days by atrophy. All tests were negative, except findings of large numbers of the proglottides of tenia solium in the stools.

Injuries

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This carries the literature to August, 1922. For previous references see v. 17, p. 449.

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DIGEST OF THE LITERATURE.

INJURIES FROM POISON GASES.—**Denhaene** observes that, in spite of the pessimistic provisions at the beginning of their use, the war gases have provoked but slight ocular lesions compared with the damage to other organs. The ocular lesions are generally limited to some slight specks on the cornea, and even these are rare. We must accept with reserve the assertion of those who impute to poison gases the ocular lesions of which they avail themselves in order to obtain a disablement pension; altho not rejecting absolutely the possibility of incurable chorioretinal lesions. The action of vesicant gases upon the posterior segment of the eyeball is limited to venous congestion of the deep membranes, and yet the latter is met with only in connection with severe poisonings of the whole organisms. As regards the blepharoconjunctivitis secondary to gas injuries, this is curable by adequate and more or less prolonged treatment, and consequently does not entitle to a percentage of disablement.

CHEMICAL INJURIES.—In **Sattler's** case, *hydrogen peroxid* solution, employed as a hemostatic agent during extirpation of the lacrimal gland and sac, came in contact with the cocainized cornea. This was immediately followed by slight cloudiness of that membrane, succeeded by superficial ulceration which terminated in a delicate macula, reducing the vision to 5/15. To determine the deleterious effect of hydrogen peroxid upon the eye, Sattler dropped solutions of this substance, varying in strength from 0.5 to 3 per cent, into the eyes of rabbits, both cocainized and noncocainized. In the latter cases the effect was unimportant, while in the cocainized eyes corneal opacities occurred, which cleared but never entirely disappeared. A discussion of the effect of hydrogen peroxid upon the eye is appended; the results obtained by different experimenters are somewhat contradictory. Sattler's experiments show that following the ill effect of cocain upon the corneal epithelium, the peroxid is able to penetrate the epithelial layer more readily and thus to cause opacities of the corneal substance proper. Moreover, the anesthesia produced by the cocain allows the irritating solution to remain longer in contact with the cornea than would otherwise be the case. The purpose of the report is to emphasize the necessity of care in the use of this drug as a hemostatic in the vicinity of the eye.

The case of *hydrogen peroxid* injury reported by **Koster Gzn** is remarkable from the fact that, before the true etiology of the condition was disclosed, the patient was treated for eighteen days for an obscure condition diagnosed as an atypical *iridocyclitis*. The left eye of a man of forty-six years presented diminished vision, swollen, hyperemic iris, slightly irregular and slightly contracted pupil, fine deposits on the lens, and deep injection of the temporal side of the sclera. The vitreous was diffusely cloudy, the ocular background hyperemic. A fine deposit gradually developed on the posterior surface of the cornea. At the end of the eighteen days of treatment without improvement, the patient was reminded by a nurse that eight or ten days before the beginning of his trouble a three per cent solution of peroxid of hydrogen had accidently been used to wash out the left eye. In the course of a further six weeks, under atropin and boric acids, the eye gradually recovered, the final vision with correction being 0.9.

In **Crawford's** case a boy had lost the sight of both eyes six years previously from *creosote* splashing into them. Examination now shows marked enlargement of each eyeball involving both sclera and cornea and resembling buphthalmos; but closer examination shows absence of the anterior chamber; the iris being adherent to and largely merged with the more or less opaque and scarred cornea. In the reporter's opinion, there is a question whether this was originally buphthalmos or a pseudobuphthalmos due to the burn.

INJURY FROM STING.—**Dorff** reports three cases in which the sting of a bee remained in the upper lid from several days to several months without symptoms, until it worked thru the tarsus and rubbed against the cornea. One sting was discovered by means of the corneal microscope and was extracted with cilia forceps. **Mlady** reports a corneal opacity due to a mosquito bite.

CONTUSIONS.—**Weed** observed injury to the eye from a blast of *compressed air*, 60 to 80 pounds. The iris was tremulous, and there was commencing opacity of the lens. Vision gradually fell from 20/40 to 20/200. In a case of vision gradually failing over a period of several months, the patient had felt something drop into the eye, followed by some pain. Tension was Schiötz 5. X-ray was refused, and transillumination was negative except as to decided thinning of the upper portion of the iris. The reporter would describe the present appearance as an Elliot operation without iridectomy.

In the case reported by **Ganguli**, a cocoanut fell on the patient's left eye from a height of thirty feet. After absorption of the intraocular hemorrhage, the vision was found to be 6/9, and the only discoverable lesion of the eye was a slight dilatation of the pupil.

In **Santos Fernandez'** case, an *opacity* in the periphery of the crystalline lens was interpreted as probably due to a blow upon the eye in childhood, sixteen or eighteen years before the examination.

RUPTURE OF EYEBALL.—**Tuxford** reports the case of a man whose right eye was ruptured at the upper margin of the cornea by a blow from a football. After an excision of prolapsed iris, healing was complete in six days.

TRAUMATIC CYCLODIALYSIS. — **Salzmann's** study of the diagnostic signs of traumatic cyclodialysis is based upon ten personal cases, including several previously described in the author's paper on ophthalmoscopy of the anterior chamber (O. Y. B., 1916, v. 13, p. 17); as well as upon several cases included in a paper published by Markbreiter on traumatic cyclodialysis (see O. Y. B., 1909, v. 6, p. 375). Salzmann states that the ophthalmoscopic appearance of such cases is characterized by the fact, that in a limited area of the anterior chamber there is a considerable broadening of the anterior surface of the ciliary body, that is to say, the angle of the anterior chamber has been extended. Within this area one recognizes gaps in the tissue of the ciliary body, thru which the white of the internal layer of the sclera glistens. The ruptures extending entirely thru the ciliary body are thus of much smaller extent than the broadening of the angle of the anterior chamber. The conclusion is therefore justified that widening of the angle of the anterior chamber is the ophthalmoscopic sign of incomplete tear of the ciliary body. Widening of the angle of the anterior chamber is rarely uniform thruout the whole circumference; being usually only clearly marked on one side, the nasal. In twelve recent cases of this injury, widening of the angle occurred only twice on the temporal side.

OCULAR INJURIES BY ARROW.—**Rötth** attributes to war psychology in children the frequent occurrence of ocular injuries by arrows during recent years. In the Budapest clinic twelve cases occurred within three years. The injuries are always severe: 83 per cent perforating, 50 per cent infected, 42 per cent traumatic cataract, and frequent iris prolapse. The cases are often late in coming to the expert.

RUPTURE OF CHOROID.—**Pattee** reports wounds of both lids, following a blow. Several days after the accident, two crescent shaped parallel ruptures of the choroid were discovered, outward from the disc and about two disc diameters in length. One of them passed almost thru the macula. Three weeks after the injury, vision was fingers at six feet; and the pupil was considerably dilated. The reporter had seen several cases in which, after a blow upon the eye, the pupil had remained permanently dilated.

Following injury by a base ball, **Simpson** observed a small *hemorrhage in the macula* with a whitish area in the center. No tear in the choroid was visible. Two weeks later the hemorrhagic area had become white with slight pigmentation, and a whitish streak ran upward from the macula. The retinal vessels could be seen coursing over the whitish streak, which represented rupture of the choroid.

RUPTURE OF OUTER CORNEAL LAYERS.—Seventeen days after an attempt at suicide by a woman of twenty years, **Bachstez** saw a deep circular furrow along the limbus. The enucleated eye presented a rupture at the posterior pole, and a perforating rupture of the cornea at the lower limbus. This perforation was continuous with a shallow furrow which ran around the upper three-fourths of the limbus, and which corresponded to a tearing of the outer third of the thickness of the cornea.

PENETRATING WOUNDS.—In **Wible's** first case of perforating wound of the cornea, a prolapse of iris occurred on the fourth day, due to refractory conduct of the boy. An iridectomy was performed, and on the following day the entire cornea had become opaque. The opacity cleared in about a week, except for a band of infiltration nearly 2 mm. in width along the line of the wound. Six weeks later a faint white cicatricial line at the site of the corneal laceration remained, with a slightly pear shaped pupil. Vision normal. In a second case there was a laceration of the cornea thruout its entire diameter, with no prolapse of the iris. On the third day opacification of the lens began beneath the line of the corneal wound, and slowly extended.

This has apparently stopped at present, leaving a clear segment of about one-sixth of the lens. Needling has been deferred until absorption of the cataractous portion is arrested.

Argañaraz observes that in penetrating wounds of the eye the practitioner may have to decide whether or not there is a *foreign body* in the eye, as the fate of the eye may depend on this first examination. The main thing is to prevent infection. Alcohol, ether, or iodin should not be used in the eyes. The writer advises copious flushing of conjunctival sac with saline solution. If the wound is in the cornea, he introduces a little 1-1000 mercuric chlorid salve with bandage as first aid. If there is hernia of the iris, this should be reduced if possible, or cut off. He emphasizes the great benefit from *parenteral injection of milk* (5 c.c. fresh milk, once daily, heated to 90° C. for three minutes only), in every grave suppurative process within the eye.

Ellett observed a clean *linear wound* thru the ciliary region, by a piece of glass. The eye recovered with vision 15/20 and a small vitreous opacity. Four years later there was a *retinal detachment,* retinitis proliferans, vision 20/200. Seventeen years later vision was lost, increased tension, eye inflamed; enucleation.

Connell reports four cases of perforating wounds of the eyeball. Case 1, explosion of a hand grenade, a fragment of which passed into the globe at the limbus, temporally, involving cornea, iris, ciliary body and lens. There was prolapse of a considerable portion of ciliary body, eyeball soft, with fragment lodged in vitreous, vision light perception; immediate enucleation, recovery uneventful. Case 2, explosion of a percussion cap. A piece of brass lodged on iris near angle of anterior chamber, the point of entrance being near center of cornea. The foreign body was removed with iris forceps thru a corneal incision. Four weeks later the eye was quiet with only a leucoma. Case 3, wound of cornea by scissors. Three hours later the iris was in contact with posterior surface at site of injury, upper half of anterior chamber abolished. Next day the anterior chamber had reformed, pupil well dilated. The eye healed with a large leucoma. Case 4, rupture of the sclera, concentric with and about 4 mm. from the limbus, the result of a kick. Anterior chamber filled with blood, vision nil. After absorption of the clot, the lens was found to have been dislocated upward, large traumatic coloboma of iris above, vitreous filled with blood. At the end of two months the vision was 20/100 with $+8 \overset{\frown}{\smile} +1$ cy.

In **Boyd's** case, iris and vitreous presented in the wound; the anterior chamber was full of blood. Boyd cut away the iris and bead of vitreous. After absorption of the blood in the anterior chamber, it was apparent that no iris tissue remained, except a small tag in the wound. There had also been rupture of the zonula and of the capsule. The lens became absorbed, leaving a dense capsular membrane. Vision, moving objects.

Stanford observed, following an explosion, a perforating wound of the cornea, from the temporal to the nasal limbus; anterior chamber empty, iris in contact with the cornea, but no prolapse. Under local anesthesia the cornea was completely covered by conjunctiva brought up from below. One week later the *conjunctival flap* had slipped off the cornea into its original position; the corneal wound had healed smoothly, pupil nearly round. Two months later vision 4/200. The poor vision is due to corneal scar and lenticular opacity. An interesting feature is the absence of prolapse of the iris.

Killick reports injury from broken spectacle lens. There were two separate perforating wounds of the cornea, thru one of which iris prolapsed. The latter was excised and the entire cornea covered with conjunctiva. Two and one-half months later the vision equalled 6/6. About five weeks after the accident, a fragment of *glass* 3 by 1 mm. was found free in the lower culdesac. The reporter ascribes the successful result to the following factors: (1) The lens, ciliary body and vitreous were intact; (2) the wounds were promptly protected by a conjunctival dressing; and (3) it is possible that the acriflavin drops which had been used played some part in keeping the eye aseptic, as the conjunctiva had been extensively soiled.

In **Matson's** case, following gunpowder explosion, a small corneal tear and iridodialysis were noted; rupture of the lens capsule and gradual absorption of lens without hypertension. The question of needling the opaque lens capsule was answered in the negative in the discussion.

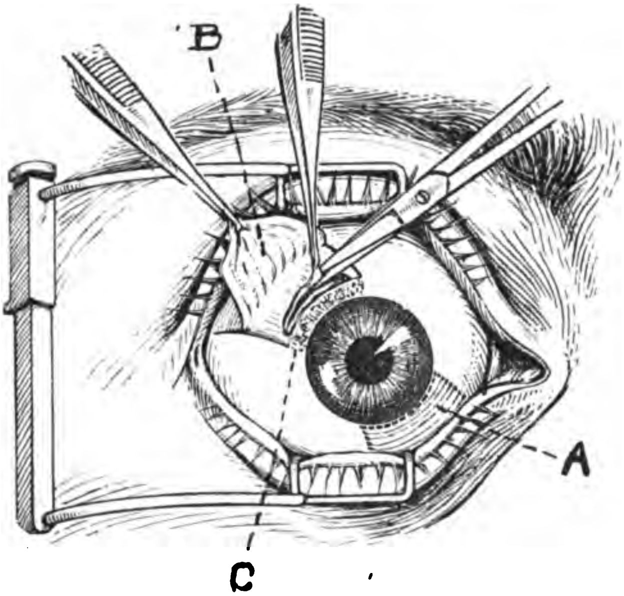

Fig. 17. A, site of flap opposite scleral wound; B, equatorial flap, elevated, and C, area of conjunctiva roughened. Toilet of scleral wound. (Francis).

In **Pattee's** case the eye had been struck with a piece of hot steel the size of a half dollar; there was a gash 6 by 8 mm. in the sclera and conjunctiva, and both tissues were burned, pupil widely dilated, iris changed in color; vision, hand movements. Four months later the pupil had remained moderately dilated, vision 20/80, fundus normal.

Würdemann's paper on perforating wounds of the eye, the use of conjunctival flaps, first aid in battle injuries of the eye, and indications for removal of an eye, is lecture three given to the class of the Army Medical School, Washington, D. C., in May, 1921. General papers on perforating injuries of the eye are also published by **Reynolds** and **Adams.**

Francis supplements a paper read before the section of the A. M. A. in 1913, in which he described a double *conjunctival flap for wounds of the sclera* situated far enough from the limbus to admit sufficient undermining of adjacent conjunctiva to fashion adequate flaps. For wounds more anteriorly placed, some other method is necessary. Altho closure with scleral sutures is sufficient in many cases, more firmness and security from infection will be gained, if such wounds can be reenforced by a proper conjunctival covering. With this in mind the following procedure is presented: The types of wound for which this technic is adaptable are: 1, scleral ruptures; 2, penetrating wounds of the sclera near, and, if linear, parallel or nearly parallel to the limbus; and 3, prolapsing cataract wounds.

Diametrically across the cornea from the wound, a tongue of conjunctiva is elevated from the sclera, wide enough to admit of several sutures and long enough to readily stretch nearly across the cornea without un-

undue tension (A. Fig. 17). If there is normal conjunctiva between the wound and the limbus, the surface is slightly denuded and roughened by means of curet or scalpel to provide union with the flap, which will later cover it (C. Fig. 17). The original wound thru the conjunctiva is then enlarged several millimeters on either side, parallel to the limbus. On the equatorial side of the wound, a thick conjunctival flap is undermined, wide enough amply to cover the wound and long enough to meet the flap already fashioned on the opposite side (B. Fig. 17). Débris and loose tags are trimmed away from the scleral wound, and if need be the edges are smoothed and freshened. The wound is then closed by means of fine silk or linen sutures which should dip firmly into the lips of the scleral wound but not entirely thru. Each suture is then mattressed thru the equatorial flap, at a point where it will cover the wound when joined to the opposite flap (Fig. 18). The two flaps are then united across the cornea by firm silk sutures; the sutures closing the scleral wound (having been mattressed thru the equatorial flap) are then tied (Fig. 19). For small wounds the equatorial flap is sufficient, but in rupture of the sclera it is best to provide a flap from the opposite side of the cornea.

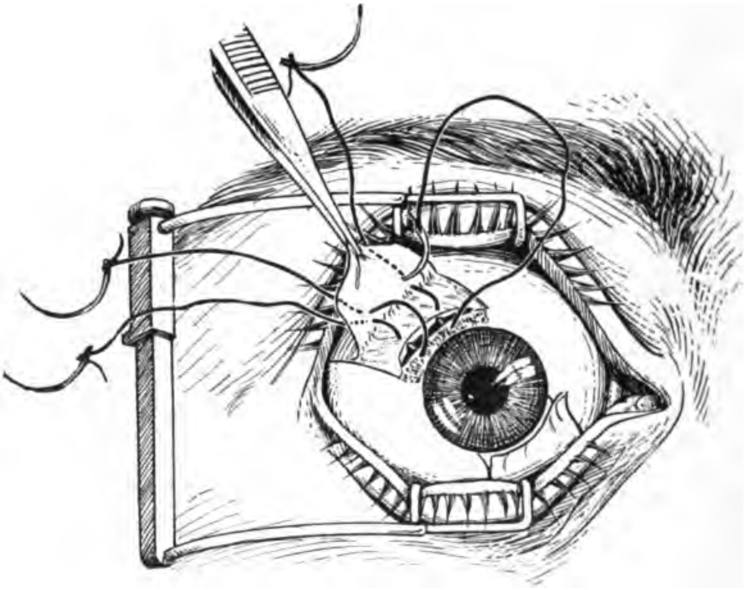

Fig. 18. Scleral sutures mattressed thru equatorial flap.

TETANUS FOLLOWING INJURY.—In **van der Hoeve's** first case, a boy was wounded in the left eye while throwing spears; the wound healed. Three nights later, he began to scream, his face was stiff and the mouth could be opened only with difficulty. On the tenth day he was admitted to the hospital; he had trismus and left facial and abducens paralysis; in the left eyebrow, there was a slight wound, from which pus was pressed, and which was connected with a second fistula in the conjunctiva; the vision in the left eye was 2/10. The wound was enlarged; and three days later a second wound was discovered, about 25 mm. in length; long wooden splinters were extracted from deep in the orbit, which contained tetanus spores. The patient died sixteen days after the injury in spite of carbolic acid injections after the method of Bacelli. The temperature never rose above 38° C.

CASE 2. A three and a half year old child came home screaming, with a bleeding left eye. The family physician could find nothing; but five days later the child began to groan. On the seventh day, the mother removed a piece of elder wood, 18 by 18 mm., from beneath the upper lid and complaints ended. But the boy came to the clinic with a mucopurulent discharge, blepharospasm and slight edema of the upper lid, with blue discoloration at the temporal side. In the upper fornix was a wound of the conjunctiva; the cornea was slightly opaque, but the pupil and iris were normal. Four days later, the mother noticed that the boy could not open his mouth easily; he put his tongue out with difficulty, and the masseters were very tense. The wood contained strong tetanus virus which killed mice in a short time. In the wound exudate from the mice, tetanus bacilli were found. During sleep the right facial occasionally contracted; there was complete stiffness of the neck; severe facial cramp, especially left; right facial spasm. The abdomen was tense, but the reflexes not exaggerated. The left oculomotor and abducens were paralyzed; the left facial remained stiff with tetanus. Spasmodic attacks were frequent; the temperature was between 37.4 and 39.4 C. One month after the injury, the child was cured; only while sneezing, which happened frequently, was his face distorted on the left side.

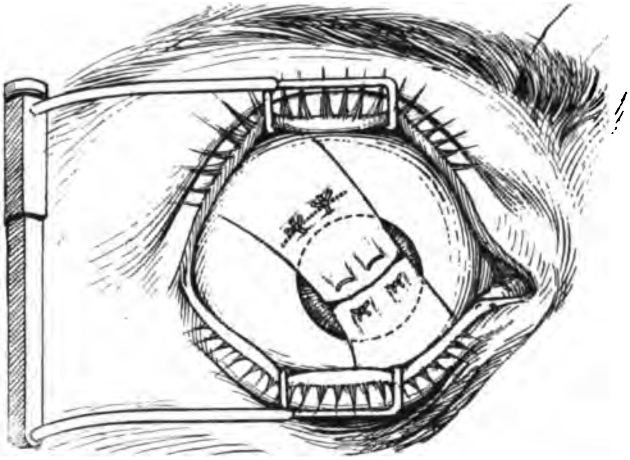

Fig. 19. Flaps in position; sutures tied.

The presence of wood in the conjunctival sac is very dangerous; small wounds here may become foci for tetanus infection. These cases also indicate that the family physician should refer to the specialist all ocular lesions which he can not examine thoroly.

In his entire experience, **Santos Fernandez** has observed only a single case of tetanus following ocular injury. He denies that the negro is particularly subject to tetanus. He considers injection of tetanus serum to be indicated in all cases of injury to the eye by foreign bodies which might possibly be infected with the bacilli of tetanus, and also in every injury to the eye from splinters of wood, as advocated by van der Hoeve.

Foreign Bodies in Conjunctiva and Cornea.—After other means had failed, **LaCroix** succeeded in extracting a foreign body deeply imbedded in the cornea by everting that structure as advised by Gayet. The danger of the procedure consists in possible loss of vitreous, or hernia and incarceration of the iris. These possibilities should make the procedure an exceptional one; but the reporter believes the dangers may be avoided by the following technic: Suture of the cornea, retrobulbar and peripalpebral injections of novocain-adrenalin, iridectomy and strict limitation of the flap.

Marin Amat was successful in extracting from the cornea of boy, of fifteen years a fragment of *cane* which had been poked into the eye thru a keyhole, and which extended thru the anterior chamber almost to the iris.

Bane advocates sealing the eye for twenty-four hours or more after removal of a foreign body from the cornea. He applies sterile vaselin in the palpebral aperture, and then covers the eye with a pad of gauze with cotton between its layers, using adhesive strips to retain the pad.

In **Scarlett's** case a small spicule of cinder, about two mm. in length, was removed from the anterior surface of the iris by forceps, after a keratome incision. An attempt at removal had been previously made without success. The question arises whether the cinder of itself penetrated the cornea or had been pushed thru by the efforts at removal.

Shuman insists upon the importance of thoro and proper removal of foreign bodies from the cornea—a matter which, he believes, has not received adequate consideration. He particularly insists upon the necessity of removing rust stain or "charred" cornea at the first treatment. After complete removal of the foreign body and, if necessary, careful and further curettment of hopelessly damaged tissue, several drops of a 20 per cent solution of argyrol should be instilled into the conjunctival sac, followed by an ointment of 1-3000 bichlorid of mercury in lanolin and petrolatum, or an ointment of 1 per cent holocain and adrenalin chlorid, with a snug patch to prevent winking. Proper illumination and magnification should always be secured; the best source of illumination in the writer's opinion being the filament lamp of the May battery in the handle ophthalmoscope, stripped of the condensing lens. The writer cautions against scraping far and wide of the mark, whereas a single delicate stroke, deep enough just to go under the foreign body at its edge is sufficient, and causes little or no damage to the surrounding epithelium.

WRITING INK IN CORNEA.—**Bourgeois** observed a black line extending entirely across the cornea, caused by injury from the point of a pen carrying ink. It was impossible to remove this incrustation mechanically; he therefore resorted to Javel's solution, employed in bleaching, a few applications of which were entirely successful.

FOREIGN BODY IN ANTERIOR CHAMBER.—**Scarlett's** case presented an adherent leucoma. A thick grayish membrane adherent to the iris filled the pupillary area, in which an eyelash was incarcerated. Focal illumination showed a small radial slit in the iris, and at right angles to this slit a small shining body which resembled a piece of polished brass. The patient's eye had been injured in 1913 by explosion of a percussion cap. A piece of brass was immediately removed; and since that time he has had only light perception. Several X-ray examinations have failed to reveal any foreign body. The special interest in this case lies in retention for eight years, without causing any apparent disturbance, of the cilium in the anterior chamber, and the suspicious substance lying beneath the iris in the posterior chamber.

To facilitate extraction of ***nonmagnetic foreign bodies*** from the anterior chamber, **O'Reilly** uses a loop, made of a two-inch strand of horse hair, fine or coarse as the conditions indicate, the free ends of which are inserted into an ordinary dental broach holder. The loop is carried into the anterior chamber thru a small incision in the cornea near the foreign body, and is passed around the foreign body. Several engagements by the loop may be necessary before the foreign body reaches the angle of the anterior chamber, and at this stage it may be necessary to enlarge the incision.

FOREIGN BODIES IN LENS.—In **Ellett's** case a chip from a hammer inflicted a wound in the cornea and iris and caused traumatic cataract. X-ray showed a large foreign body. This was drawn by means of the large magnet into the anterior chamber, whence it was removed by an incision and iridectomy. There was violent reaction without infection; loss of the eye seemed probable. The foreign body measured 5 by 2 by 8 mm.

In a second case, also following a blow by a chip of metal from a hammer, a foreign body was localized in the lens by X-ray. The lens being already opaque, was extracted; the foreign body did not come away with the lens, but was removed with the magnet; vision 20/30.

Lampert remarks that grave visual disturbances following apparently trivial injuries are not very rare. He reports two instances: in the first case, in 1920 or earlier, a metallic body had penetrated the cornea and lodged in the periphery of the lens. The pupil must have been in a state of mydriasis at the instant the accident took place; and supervening contraction brought the posterior surface of the iris into immediate contact with the wound in the anterior capsule; a small amount of pigment remained adherent to the wound, closing it at once so that the aqueous humor could not enter, and thus prevented further damage to the lens.

In the second case, a foreign body entered the lens without the knowledge of the patient or his attendant. One remained upon the surface of the cornea, and in removing it the second was overlooked. From these observations a conclusion may be drawn that the diagnosis of a foreign body in the lens is not always easy; principally on account of the ignorance of the patient, who is unaware of such a possibility. A superficial lesion may mask a deeper one; the foreign body is invisible on account of its position; and functional disturbances may be tardy in appearing.

Simpson observed a foreign body which with the ophthalmoscope appeared to be in the posterior part of the lens, seemingly with no opacity of that structure.

FOREIGN BODIES IN VITREOUS.— **Giraud** observed an industrial injury presenting all the clinical signs of an intraocular foreign body. Ordinary radiography confirmed the presence of an intraocular foreign body, but without precise localization. *Stereoscopic radiography* localized the body, exactly at the postero-inferior pole of the globe; Rochon-Duvigneaud performed extraction as follows: Division of the external rectus, application of the point of the magnet (after reclination of the eyeball forward) to the posterior part of the globe; mobilization of the foreign body into the anterior chamber, and extraction. It is of interest to note that the eyeball could only be turned sufficiently forward and upwards by means of an intrasclerotic thread inserted far behind the insertion of the inferior oblique. Healing normal; no operative strabismus. Vision nil following the accident and remained so.

Spencer and **LaRue** observed, following injury, a small perforation of the iris and a corresponding wound in the cornea. The path of the foreign body thru the lens was clearly visible, and a minute foreign body was seen in close proximity to the posterior lens capsule; this was verified by X-ray. The foreign body, 0.5x1.5x1.5 mm., was extracted with the hand *magnet,* by Finnoff. More than two weeks after the the accident, no opacity had developed in the lens beyond the bare indication of the path of the foreign body; vision 6/4.

Bell reports a foreign body in the globe for 15 years. There was a scar on the cornea and opacity in the lens. In the clear vitreous, a worm like mass could be seen above and anterior to the disc; X-ray revealed a foreign body in its vicinity. As the eye shows no siderosis, and was quiet (vision 20/70) it was advised to leave it alone.

In **Black's** case of injury from explosion, the vision had been disturbed from the time of the explosion. Examination the next day revealed a blood spot area over the internal rectus, the ophthalmoscope showed a number of large shreds in the vitreous and an opaque body resembling metal. Central vision was 20/20, but a very large sector of the field was lost above.

Radiography showed a small metallic foreign body, which proved nonmagnetic. The vision gradually fell to finger movements in the lower part of the field; no change in the iris. The foreign body was probably copper or brass.

Ellett observed injury to the eye, by a chip of steel from a hammer the day before. There was a small wound in the conjunctiva, and the vitreous was full of blood. This was before the days of X-ray and the presence of a foreign body could only be surmised. The eye cleared rapidly, and in two weeks vision was 15/40; fundus dimly seen. The patient was not seen again for 22 years. The eye had been blind about 9 years; pupil filled by an organized membrane, iris slightly discolored, new vessels on the surface; the eye was acutely inflamed. The X-ray showed a foreign body in the vitreous; attempted removal by magnet unsuccessful. The eye has been comfortable since the attempt.

In a second case injury was followed by rupture of the choroid; the X-ray showed a large foreign body partly in the globe. An incision was made over the internal rectus and a piece of steel, 10 by 4 by 3 mm., removed with the magnet, without entering the eyeball. Antitetanic serum was given and the eye promptly recovered.

In **Ellett's** case, following removal of a foreign body from the vitreous, the inflammatory symptoms increased, with the formation of a yellowish margin in the anterior chamber; the eye was enucleated six weeks after the removal of the foreign body. Sections showed total detachment of the retina, and the vitreous was represented by a peculiar looking mass extending forward into the anterior chamber.

In **Sedwick's** case the eye had been injured two years previously; there had been slight inflammatory reaction. A few weeks later vision again failed, with streaks before the eye. The more recent disturbances had begun about one month ago. Vision 6/100; iris a good deal discolored, presented a wound opposite to a very small corneal scar; lens cataractous, X-ray showed a small foreign body, probably lodged in the posterior ocular wall. Attempts at removal were considered inadvisable.

Weisser reports perforation of the eye by a foreign body, penetrating the cornea, iris, and lens. X-ray showed it to be located in the vitreous, 12 mm. back of the cornea; the magnet was applied but without response; three weeks later a peculiar looking object was noticed upon the iris; the X-ray showed the foreign body 3 mm. behind the center of the cornea. An opening was made in the cornea and the magnet applied without success. The foreign body had moved from the vitreous into the anterior chamber in front of the iris. The patient thinks the foreign body is nonmagnetic babbitt metal. The lens is entirely cataractous with large posterior synechia. In the discussion the consensus of opinion was that the foreign body should be removed.

In **Strader's** case of foreign body in the vitreous, upon using the *giant magnet* the fragment caught in the iris; and it had to be removed thru a scleral incision. The result to date of report was diminishing light perception and projection, lowered tension and perceptible shrinkage of the eye.

FOREIGN BODY IN THE RETINA.—**Story** presented a boy whose eye had been penetrated by a percussion cap which could be seen in the retina. Those who discussed the case were in favor of leaving the eye alone.

FORCEPS EXTRACTION OF FOREIGN BODIES FROM THE OCULAR FUNDUS. In a number of cases where foreign bodies in the vitreous were clearly visible thru the pupil with the ophthalmoscope, **Hertel** has followed the practice of extracting the foreign body thru an appropriate opening in the sclera by means of long forceps, which could conveniently be observed with the ophthalmoscope. In two cases of steel splinters which lay in thick exudate, one peripherally, the other in the optic disc, and in which all attempts at extraction with the magnet had failed, the mass of exudate was first broken up and removed with the forceps under the guidance of the ophthalmoscope, and then magnet extraction was successfully performed. When the location of the splinter is concealed by a cataract, the latter should be removed in order to render the foreign body visible thru the ophthalmoscope.

Tolerance of Eye to Foreign Bodies. Statistics from the Budapest Eye Clinic are presented by **Waldmann** to illustrate the tolerance of the eye for foreign bodies. Between 1914 and 1920, 456 eyes containing foreign bodies came under observation. Of these eyes 77 were strikingly tolerant. They included five foreign bodies in the depth of the cornea, two in the sclera, seven in the anterior chamber, four in the iris, six in the lens, thirty-nine in the vitreous, and fourteen in the retina. The longest stay of the foreign body was twelve years, and in the other cases the period varied from a few months to several years. The nature of the foreign body in these cases of special tolerance was: steel seven, iron sixteen, copper and brass eight, granite twenty-two, shrapnel six, explosives six, small shot one, dynamite two, lead one, splinter of bomb one, stone two, glass one, and eyelashes four.

Migrating Splinters of Iron.—In **Hildesheimer's** case, a man suffered injury from an iron splinter in 1907: he was operated upon several times but the foreign body could not be removed, and the eye became blind. Eight years subsequently the man was referred to Hildesheimer for a supposed luetic iritis. He found a cicatrix at the limbus, artificial coloboma, circular posterior synechia, lowered tension, no trace of siderosis; test with the sideroscope most marked upon application to the cornea; vision hand movements. In 1920 the patient returned on account of pain; the point of an iron splinter was now visible in the cicatrix; this point gradually came forward so that in eight days the splinter could be removed with the forceps. Complete spontaneous absorption of the remains of the lens took place; the visual acuity rose to 5/15 with cataract glass. The reporter suggests that mercurial treatment of lues may have freed the splinter.

In the case recorded by **Hanke**, a minute piece of steel passed thru the iris and lens and lodged approximately in the sheath of the optic nerve at its entrance into the sclera. Five weeks later, X-ray study showed the foreign body 3.5 mm. deeper in the orbit, 1.5 mm. lower down, and about 6 mm. toward the temple from its original position. After a further nine weeks, its position had again changed 2 mm. backward and 7 mm. toward the nasal side. The author attributes the sinking of the foreign body to the convergent and divergent movements of the eyeball during use; and also perhaps in part to the traction of scar tissue in relation with an injured bloodvessel.

Multiple Steel Fragments in Eye.—In a penetrating wound of the cornea with light perception and light projection, **Simpson** first removed a small piece of steel; the magnet was again applied and quite a large piece of steel was removed after enlarging the wound. A first X-ray examination had shown a foreign body in the lower anterior part of the eye; a second study with the X-ray had located the smaller body.

Hennicke observed two intraocular splinters of iron with a small wound of entrance; one had penetrated the cornea and iris, being still present in the wound; it was readily extracted with forceps. The following day another pointed splinter was visible in the iris, wound extending into the anterior chamber. This foreign body was readily removed by the magnet after section of the cornea. It was extremely minute, hardly measurable, weighing 0.0003 gr. Recovery uneventful. The impinging splinter had apparently split during entrance, one part of it penetrating the iris without injuring the lens, the other adhering in the cornea; by a fortunate chance the intraocular pressure brought the posterior splinter again into the perforation of the iris.

Injuries of the Eye with Hoe Splinters.—**Haab** has studied the incidence of injuries of the eye from hoe splinters, with special reference to the geologic circumstances involved. His statistics include 277 patients with a total of 230 injuries from hoe splinters. They show a close connection with the geologic character of the earth, that is its richness in stones, and are therefore limited to the post glacial and interglacial boulder fields of the last ice age, which in Switzerland occur principally in the cantons of Zürich and Aargau. In other districts of Switzerland this type of injury is unknown.

More than a half of the injured persons are females. Loss of the eyeball occurred in thirteen percent of injuries of the anterior segment of the eyeball, whereas sixty-four percent were lost in cases of vitreous injury. In cases operated upon with the magnet, these numbers fell to four percent for the anterior segment and fifty-two percent for the posterior segment. A distinct difference as to results is noticeable upon comparing the percentages before and after introduction of the *giant magnet.* Out of 122 cases observed between 1892 and 1919, the giant magnet was employed in 103, and was successful 85 times. The eye was lost in 60.8 percent out of a total of 230 cases of injuries from hoe splinters.

LOCALIZATION OF FOREIGN BODY BY FLUOROSCOPE. Upon the basis of a clinical case which he reports, **Burwell** recommends localization of metallic foreign bodies in the eye and orbit by means of the fluoroscope,. If the foreign body is in front of the center of rotation of the eyeball, the movement of the foreign body will be with the movement of the eye, and the farther forward the greater will be the range of movement. If the foreign body is behind the center of rotation, the direction of movement of the foreign body will be opposite to that of the movement of the eye. In the case recorded, the foreign body made wide excursions in the direction opposite to that of movement of the eyeball, proving that the foreign body was at least partly in the globe, altho at its posterior pole. After enucleation, the foreign body was found to be half in the globe and half in the orbit.

MAGNET EXTRACTION. — **Lancaster** summarizes his examination of eye magnets in most common use. He finds most of the magnets to possess certain virtues in common and certain defects. Being now made with fairly strong coils, which will heat up if left too long with the current on, the magnet is not using so much current as it might, if properly designed for eye operations. The hand magnets are mostly too large for delicate manipulation; they gain nothing in power of contact pull by their size, and for pull at a distance it is better to have a really large magnet. There is too often a loss of efficiency by the cores projecting too far from the coil before the pole piece begins. Very important is the lack, in most magnets, of a smooth blending of pole piece with core, without angles or sudden changes in diameter. The slender part of the pole piece is needlessly long in many models; some have no tip small enough to introduce thru a small incision. One form of alternating current magnet tested, strikingly showed the unsuitability of the alternating current for eye magnets.

The large, or giant magnets, do not make so good a showing as the hand magnets. Most of the large magnets are of the Haab model, and this is a particularly poor model. The core is too short and the coil far too thick and bulky. A magnet of the same weight can easily be made twice as strong; even the strongest giant magnet has no power to spare, when used to extract a fragment imbedded in exudate. The writer speaks well of dry cells and storage batteries when better sources are not available.

Gigglberger has made iron injuries with magnet operation the subject of a thesis.

Gilbert believes that the sphere of usefulness of the giant magnet may be enlarged by attaching to it a sharp point which will facilitate introduction of the pole into the interior of the eyeball.

After enumerating the different forms of electromagnets (twenty-three in number), **Frenkel** gives a detailed description by Aufaure of the electromagnet constructed for the ophthalmic clinic of Toulouse. This magnet, altho weighing 377 kg., is easily managed and readily brought into any position. Before proceeding to extraction of a foreign body, diagnosis of its presence, magnetic or nonmagnetic nature, and exact situation must be made. This requires the history of the accident, personal examination including radiography, and the use of electromagnet for diagnostic purposes, as laid down by Rollet (Arch. d'Ophtal. Mar. 1920, p. 120). Regarding the personal history, the patient is frequently mistaken as to the nature of the foreign body, whether steel or other substance. Direct examination frequently fails to reveal the point of entrance; the ophthalmoscope is of diagnostic value only in a minority of cases. The greatest reliance must be placed upon radioscopy and radiography, the latter of which is preferable. The question whether radiography is indispensable is a subject of controversy. Rollet declares that the giant electromagnet makes the diagnosis, from the pain elicited when the foreign body has been drawn into contact with the iris; the iris may be observed at that instant to be pushed forward, followed at times by a small hemorrhage if the foreign body is at all voluminous. Asmus's sideroscope has not excited much enthusiasm.

The greatest differences of opinion relate to two points; the form of magnet to be employed, whether large or medium; and the route to be chosen, whether anterior, corneal, or posterior, scleral. Frenkel gives the pros and cons of both methods and cites authorities in support of each. He gives the technic of each method somewhat in detail. The paper concludes with a discussion and analysis of operative results.

FOREIGN BODY IN ORBIT.—In **Holloway's** case, the injury was caused by the explosion of a piece of iron pipe, which had been loaded with powder. The X-ray revealed an enormous foreign body, the lower end of which appeared to be free in the nasal cavities with the upper end lodged in the orbit. Since extraction from the orbit would have been impossible without breaking down the inner wall, a rhinologist, Dr. Geo. Fetterolf, removed the mass under ether, thru the nasal cavity. It was found to be a horizontal section of the pipe, 42 mm. in length by 12 mm. in breadth. The globe had been so severely injured as to lead to atrophy.

GUN SHOT WOUNDS.—In **Dean's** case a shot in the right temple one year previously caused loss of sight in both eyes. The bullet was seen to be pressing in the left upper cul-de-sac, and was removed. Bushman had seen this patient at the time of the injury: the right eye was entirely collapsed. due evidently to rupture from concussion at the back of the eye; the optic nerve of the left eye had evidently been cut by the bullet. Gifford had also seen the patient and said that the globe showed typical rupture, the anterior part of the eye not having been touched by the bullet.

Ellett observed injury to both eyes from bird shot. Right eye: wounded in limbus with large iris prolapse; iridodialysis downward; no vision; no reflex; tension reduced. X-ray showed a shot in the right orbit, 32 mm. behind the cornea; a double perforation was therefore probable. The prolapse was excised and the limbal wound covered with a conjunctival flap. The eye remains blind. Left eye; small amount of blood in anterior chamber; perforation of lower lid in outer third; fundus dimly seen, vitreous opacities, tension normal. X-ray showed a foreign body at apex of left orbit. The eyes have cleared and vision is better in the left.

Spitze reports two cases of penetrating wounds by bird shot. In the first, the perforating wound of the right globe was 6 mm. below the cornea. The left eye presented a small perforating wound in the upper lid, but none could be discovered in the globe. X-ray showed a small shot in the right orbit, below the optic nerve and about 4 mm. back of globe. Another shot was in lower portion of the left antrum. Vision right eye, 10/150, left 20/150. The next day, the ophthalmoscope showed in the right eye a small, apparently perforating, wound in the lower portion of the fundus, with hemorrhages; in the left eye, some retinal exudate with small hemorrhages. Five weeks after the injury there was detachment of the right retina in the entire lower temporal quadrant. This became entirely reattached, with vision 20/200. Left eye, vision 20/24. A small detachment of the right retina reappeared. Six months later there was complete posterior synechia of the right eye, globe much injected and soft; vision nil. Left eye had recovered vision of 20/20.

In the second case, a shot had penetrated in the extreme nasal portion of the sclera; vitreous was filled with fine floating shreds, no details; vision, movements of hand at two feet. X-ray showed a shot imbedded in the orbit.

In **Blue's** case the patient was shot in the face with No. 7 bird shot, 20 steps from the gunner. A week later the conditions were as follows: Right eye, cornea and lens clear, no fundus reflex from lower portion of the eye, reflex above, no details; vision, fingers at about 10 feet. Left eye, conjunctiva chemotic, protruding between lids, cornea clear, wound of entrance 1 mm. above sclerocorneal margin, prolapse of iris, no fundus reflex, movements of globe very limited.

The question of *ricocheting shots* is much discussed, but actually the exact study of the conditions in which they occur is still undecided. General Journée has made some experiments as to the power of penetration of ricocheting shots at varying angles and character of surface upon which they impinge. In this connection **Morax** reports the case of a hunter in whom such a shot struck the globe tangentially, and reached the apex of the orbit. The shot caused only a slight equatorial retinal hemorrhage which did not affect the visual acuity. See Baer's case below.

AVULSION OF OPTIC NERVE.—**Crigler** reports injury to the eye by a blow from a finger. Examination the following day showed laceration of the ocular conjunctiva with a slight cut in the margin of the lower lid, as from a sharp finger nail. Pupil dilated and immovable, eyeball soft, no fundus reflex, vitreous filled with blood. A week later the nerve head could be seen distinctly as a perfectly white round disc, excavated and devoid of any visible vessels. A distinct laceration of the retina and choroid at the margin of the disc was evident from the sudden termination of the retinal vessels around the margin of the disc, with cloudy swelling and slight pigmentation of the retina. The peripheral portion of the retina, which immediately after the injury, was evidently deprived of blood, and hence no longer transparent, had, by the time the fundus was visible, become transparent. The retinal circulation was by some curious means partially restored, altho there was still no blood in the main trunks, beyond the laceration. The lamina cribrosa was ruptured, as evidenced by deep excavation of the nerve head. There was a brownish black mass at the bottom of the excavation; presumably a blood clot, as it has now disappeared, and the deep cup is gradually filling in with connective tissue. Three large stream like hemorrhages extended out into the vitreous, so that one appeared to be looking at the optic nerve head as thru a funnel.

The unusual feature in this case is the fact that the avulsion was due to direct force applied to the eyeball, whereas in most cases the cause is a penetrating wound of the orbit in which the nerve is torn from the eyeball. Here we have the effect of suddenly increased intraocular pressure transmitted to the head of the optic nerve, the lamina giving way, and the retinal fibers being torn from the nerve at the margin of the disc. The dural sheath of the nerve is probably intact.

In **Baer's** case, in 1914 a shot from a 32 caliber revolver entered the right temple, and passed across the right orbit, directly back of the right eye and thru the nares and the left orbit. Immediate blindness of both eyes occurred, with ptosis of the left upper lid and paralysis of the superior rectus muscle on the left side. The blindness of the right eye has remained permanent; five months after the injury the vision of the left eye had so far improved that large objects were discernible. In 1919 the left eye was struck with a piece of wood, traumatic cataract resulting. A Tansley-Hunt operation was performed on the left upper lid with good effect, and later an attempt was made to remove the cataract.

Present condition: Right eye, pupil widely dilated and nonreactive; a few fine vitreous opacities; whitish area at posterior pole, irregularly round and about three times the normal disc in size. This area is completely ringed by a band of choroidal pigment. Superimposed in the center of the whitish area is a mass of proliferating retinal tissue, in which are a number of small adventitious vessels. The entire periphery of the fundus shows widespread disturbance of the choroidal pigment; retinal veins, greatly contracted, can be traced to the edge of the whitish area; retinal arteries absent. The left eye presents a narrow upward coloboma (operative) and the pupillary space is filled with a thick secondary membrane thru which no fundus reflex is obtained. Vision, light perception in the temporal field only.

In the discussion, Zentmayer stated that he had exhibited this patient in 1919 with a diagnosis of avulsion of the optic nerve. The fundus of the right eye has little changed since then; the lesions are largely those of proliferative retinochoroiditis. In the left eye an iridectomy has been made with the hope of improving the vision, which at the time was light perception; the patient now has form vision.

In a case of suicide observed by **Rötth**, a pistol shot in the right temple tore away the posterior segments of the ocular muscles and a 15 mm. length of the optic nerve, the position of the optic disc being represented by a round hole.

INJURY OF ORBIT.—**De Lapersonne** writes that orbitoocular injuries of war, being rarely limited to the orbit, require the ophthalmologist to intervene in craniofacial wounds. The most frequent extensions of orbital injuries are: 1. Multiple fractures of the malar bone extending to the zygomatic arch of the superior maxilla; 2, fracture of the superior maxilla involving the sinus; 3, fractures of the upper margin of the orbit extending to the base of the brain, with all its consequences; 4, fractures of the superior internal angle involving the frontal and ethmoidal sinuses. Such orbital injuries are likely to be attended by the chorioretinal lesions studied by Lagrange. The most frequent complications are meningitis and meningoencephalitis; tetanus has been rare and gas gangrene has not been observed. Infection of such wounds is usually secondary, but the benefit of early treatment is very striking. Exact diagnosis and early treatment under local anesthesia are of great importance. Sutures should be applied after removal of the foreign bodies. Extensive orbital lesions may require free orbitotomy to permit removal of foreign bodies, fragments of bone, or large hematomas.

TEAR OF INFERIOR RECTUS.—**Hird** reports the case of a girl, aged fifteen years, whose inferior rectus muscle was torn by a cow's horn from its attachment to the globe. On account of sepsis, treatment was postponed until five months later; when the inferior rectus was sought and reattached and the superior rectus tenotomized. The result was good.

CRANIAL FRACTURES INVOLVING ORBIT.—**Kehl** discusses at considerable length the diagnostic significance of the lines of distribution of blood, escaping into the conjunctiva of the lids and eyeball after fractures in the region of the orbit. With fractures of the thin layers of bone which form the base of the skull and large portions of the wall of the orbit, are associated separation or tearing of the dura and periosteum and the rupture of bloodvessels. The blood from these vessels follows the lines of least resistance, especially along the sheaths which accompany the nerves and bloodvessels thru their points of exit from the cranial cavity. Fractures of the base of the skull extending into the superior orbital fissure are especially apt to be associated with bleeding which escapes along the accessory head of the external rectus muscle, to appear beneath the bulbar conjunctiva in a pennant shaped area, with its base at the external limbus and its apex beneath the outer canthus.

A severe blow upon the malar bone may be accompanied by fracture of the base of the skull, in which case, in addition to a readily determinable fracture of the malar bone itself, the blood pennant may appear beneath the conjunctiva.

Kehl has observed this characteristic *subconjunctival hematoma* in four cases of trauma of the corresponding side of the face. In each instance the injury occurred in the neighborhood of the eye, and was early followed by evidence of concussion of the brain. There was unconsciousness, altho in two cases it was of short duration. Vomiting and bleeding from the nose were present in each case. A line of fracture could be definitely determined by X-ray in one case only. But in all four cases a hematoma of the bulbar conjunctiva, in the characteristic location along the external rectus muscle on the affected side of the skull, was distinct and persistent. In one instance the hemorrhage appeared on the first day and was very pronounced, causing mechanically a paralysis of the abducens muscle. Since this paralysis disappeared after five days, simultaneously with retrogression of the accompanying hemorrhage of the lids, it could not have been occasioned by injury of the abducens nerve. The subconjunctival hemorrhage is usually first apparent on the second day after injury.

LUXATION OF EYEBALL.—In the case reported by **Curry**, the patient's head was caught between the floor of a descending elevator and the top of a safety gate. The scalp was pulled forward from the occiput and drawn from both of the parietal and frontal bones. Both eyeballs were completely pulled out of the orbits. There was absolute blindness, the corneas gradually sloughed, and the patient developed symptoms of meningitis after eighteeen days and died after twenty-one days.

INJURY OF TRIGEMINUS.—**Tiscornia** observed an injury of the internal orbital margin with hematoma, and a series of lesions and symptoms as follows: Perimacular hemorrhage, paresis of the external rectus, marked anesthesia in the distribution of the superior maxillary, and also of the terminal branches of the ophthalmic nerve; anosmia of the same side and diminuation of hearing. The interpretation of such wide spread symptoms is difficult. The anesthesia of the branches of the trigeminus with paralysis of the rectus would indicate a lesion at the apex of the orbit; but this will not explain either the deafness or the anosmia. Bárány's test failed to cause nystagmus. Neurologic examination, while confirming the presence of all the lesions noticed, was equally unable to account for them. The anosmia may be due to compression of some of the fibers of the olfactory by the hematoma, but this does not account for the deafness or the anesthesia.

GENERAL PAPERS.—**Jocqs** observes that the pathology of ocular traumatism has received a great extension during the war; every imaginable kind of wound has been observed. Direct wounds, tho extremely numerous, have taught nothing essentially new. Not so with indirect traumatism, that is such as has caused severe intraocular lesions without wounds of the globe, and in some cases even without the globe having been directly touched by the projectile. Before 1914 numerous lesions of the intraocular tissues consecutive to contusion of the globe were known. About 18 years ago Jocqs himself observed, following contusion, a central scotoma without apparent lesion of the macula; complete recovery occurred. All such cases are readily explicable by direct contusion of the eyeball.

But intraocular lesions consecutive to indirect traumatism which has not effected the eyeball itself, tho of rare occurrence, are not easily explained. In this connection he recalls a case reported by himself in 1897, of injury in the temple from a revolver shot. The ophthalmic appearances were undoubtedly those of a perfectly circular rupture of the choroid with atrophy of the papilla; later, extensive detachment of the retina occurred. Jocqs explained the phenomena at that time as due to traction by the nerve upon the posterior pole of the eye. At the same time, contracoup also plays a rôle in such injuries. He concludes that his case was an instance of what has been so frequently observed during the war, indirect ocular lesions from avulsion of the nerve and contracoup.

Campos reports a case of radial rupture of the iris without traumatism in a man, aged 45 years. The subject of ocular traumatisms is covered in appreciable detail for Spanish readers in reports of lectures delivered by **Argañaraz.**

General Pathology

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This section reviews the literature from October, 1921 to September, 1922. For previous references see Ophthalmic Literature, v. 17, p. 483.

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DIGEST OF THE LITERATURE.

HEREDITY.—**Vogt**, under the name of "sexually related diseases," discusses various formulas showing the possible transmission of disease thru healthy mothers to male offspring. **Seefelder** utilized the female guinea pig with colobomas, breeding with normal males, getting many offspring with colobomas and cataracts both partial and complete. Previous experimenters have used the colobomatous male. **Fleischer** describes, as myotonic dystrophy, a progressive disease which is dominant in the Mendelian sense. In addition to atrophic changes in muscle tissue and fat, there are trophic and vasomotor disturbances shown by baldness and cataracts. The same author, in another communication, urges the importance of collecting material for the study of hereditary transmission according to Mendel's law. Inheritance of ocular coloration is the subject of a paper by **Winge.**

IMMUNITY.—**Meisner** and **Uchida** attempted to produce immunity to tuberculosis by ocular injection of Friedmann's turtle bacillus. Using virulent bovine tubercle bacilli injected into the gluteal muscles, and comparing the results in controls, they conclude that the Friedmann bacillus produces no local immunity.

ANAPHYLAXIS AND SEROLOGY.—**Kodama** found eye tissues (of the cow) toxic to guinea pigs in the following order: lens, uveal pigment, retina, optic nerve, uvea, cornea, vitreous. The lens is 1408 times as toxic as the vitreous. He divides anaphylactic reactions into acute anaphylactic death, moderate or severe reactions, and mild symptoms. In general no great difference appears between reactions with different eye tissues and sera. Kodama differs from most experimenters in denying that there is any absolute organ specificity. He finds that each eye tissue has several anaphylactogens (antigens) in varying amounts, in addition to a specific or chief antigen peculiar to itself. Cornea and vitreous contain anaphylactogens common to all the tissues of the eye. Lens and uvea contain the smallest number of associated anaphylactogens. Thus, the active agent in sympathetic ophthalmia need not be uveal pigment alone. This conception allows for the papilloretinitis as well as the uveal inflammation of sympathetic ophthalmia.

Yamada, using cow's eyes, finds autolytic substances in various eye tissues, which are hemolytic to both homologous and heterologous blood corpuscles. At first they contract, then dilate, capillary blood vessels, increase blood pressure at first and then lower it, and dilate the pupil of the extirpated frog's eye.

CYTOLOGY.—**Neumann,** attempting to reconcile differences in various experiments as to the motility of cells in the dead cornea, concludes that leucocytes travel to surrounding tissues from transplanted corneas, both normal and after subjection to heat, formalin and silver nitrat. **Rados** states that certain substances of known chemical composition (silver nitrat, lugol, lactic acid) and others of unknown composition (toxins, dead bacteria, animal albumins) are eosinotactic. ***Eosinophiles*** may be mononuclears. They are found in chronic granulomas, as mycosis fungoides, tubercle, skin sarcoid, capsule of the echinococcus and cysticercus, trichinosis, sputum of asthmatics, etc. He describes eosinophiles in three eyes, a glaucoma with hemorrhages, a recent perforating injury, and an old perforating injury with chalky degeneration. He concludes that the origin of eosinophiles is not settled, and that no relationship exists between local and blood eosinophilia.

Michail has written on eosinophilia of the eye, especially with regard to vernal and phlyctenular conjunctivitis.

Fuchs discusses, not eosinophiles proper, but cells which have basophilic granules by Giemsa stain and red granules by hemalaum-eosin. He calls them "fakultative" eosinophiles; they have single nuclei, not polymorphic.

Fuchs, Sr., has already described them as "granular" cells in certain types of chronic endogenous uveitis. He considered them as mast cells and thought that the Russell bodies come from them. A. Fuchs found them in normal eyes as well in a variety of diseased eyes. They vary greatly in size of granules and affinity for eosin, but all forms show similarity to plasma cells. He gives them the name of "plasmacytoid" cells. They constitute a large, not sharply defined, class coming from the plasma cells; mast cells are a sharply defined group closely related to these. They measure from 8 to 18 μ, being smaller in more compact tissues; they are elongated, elliptical, or egg shaped, and may be round in the loose tissue of the normal iris.

In elongated forms, which look like connective tissue cells, the nucleus is at one end. The border is sharply defined, or not; some have a vacuole near the nucleus. The nucleus is large, (1/3 cell diameter), round, centrally placed or slightly eccentric, often rich in chromatin. It may be darker at the periphery and brighter in the center; often there is a large nucleolus. Early stages show a very dark stained nucleus like a lymphocyte; also a very dark staining occurs in the pyknosis of late stages. The protoplasm is abundant and has very large granules in chronic inflammations. The granules are very variable in size. In H.-E. stain they are bright red. The cells are like eosinophiles under low power, but do not have the same form of nucleus. Fuchs discusses the staining qualities with various stains. He believes that numerous transitions from the plasma cell occur with various staining qualities, and represent various ages of cells and in part degenerate forms of plasma cells. He found them in the iris, the vessel layer of the ciliary body, the suprachoroidea, choroidea, and subconjunctival tissue. He believes Russell's bodies to be one of several end products of plasma cell degeneration.

OCULAR TENSION.—**Hamburger** has investigated the ocular tension in both local and general disease with reference to Léber's filtration theory. In most inflammatory processes there is increased tension in the parts involved; for example, phlegmon, arthritis, etc. This is not usually the case in inflamed eyes. Exceptions are acute glaucoma, panophthalmitis and severe hypopion ulcers. Iritis generally has a low tension. Hamburger's studies included normal eyes in cases of general inflammation and diseased eyes. In the former group, the eyes were soft in 34 cases, including typhus, grippe, angina, tuberculosis and sepsis, in the stage of fever and convalescence. The lowest tension was found in typhus (6 mm.). No loss of function occurred with this low tension. No case showed a tension above 20 mm. Fever per se has no effect on tension; it may sink to a pulpy consistency without damage. Hamburger believes a tension of 25 to be not the rule but the exception; 10 mm. or less is a healthy tension. In the group of diseased eyes, he found the tension softer than normal in 24 of 35 cases. He considers that Schlemm's canal has received too much attention, that Fischer's theory of the swelling of colloids in an acid medium is worthy of more attention, and concludes that we are only at the beginning of our knowledge of the question of ocular tension.

TISSUE GROWTH IN VITRO.—**Von Szily** describes a method of growing tissues in vitro in order to study the primitive powers of growth in cells unhampered by physiologic or pathologic influences in the body. He found extensive wandering of epithelial cells of the cornea with ameboid movements.

PIGMENT FORMATION.—**Miescher** refers to the work of Bloch, showing that the pigment in hair and skin comes from the action of an oxidising ferment, the dopaoxydase. If cross sections of skin are submitted to an aqueous solution of dioxyphenylalanin (Dopa) a black color results from oxidation; this is a strongly specific reaction. Miescher concludes that pigment genesis in the retina is similar to that in the epidermis, the function of an oxydase. The ferment acts only in fetal life; this is also true of the pigment in the choroid and the pecten of birds.

Eye pigment is not altered by postnatal influences as is the skin pigment by X-rays and light, for example. There is always the potentiality of pigment development in the epidermis; in the eye, pigment development is an attribute of embryonic life. Melanotic sarcoma is an exception, but the cells from which this tumor arises are of embryonic character. The skin and eye are of both epithelial and mesothelial origin. In the pigment cells of the skin, the dopareaction is always negative, there being no oxydase. Connective tissue cells of the skin phagocyte pigment which comes from the epidermis. Pigment cells of the choroid contain an oxydase; they build pigment and do not get it from epithelial cells. Pigment granules have 2 components, a pigment bearer (albuminous) belonging to the plasma, and a pigment or coloring matter related to other well known pigments, as safranin, pyronin, methylviolet, etc. There is no proof that pigment comes from the cell nucleus.

EXPERIMENTAL TERATOLOGY.—**Hertwig**, continuing his experiments upon frog larvae, used smaller doses of X-rays and radium by reducing the quantity of radium and increasing the distance of the X-rays. With 1/16, 1/8, and 1/4 the erythema dose of X-rays, he obtained 3 degrees of damage to the frog spermatozoa. With the weakest dose, 25% of larvae were abnormal; with the intermediate dose, 75% were abnormal; with the strongest dose, all larvae were abnormal. The highest grade of abnormality consists of an antero-posterior strand of pigment cells remaining below the surface, with no lens. With less damage, the optic cup invaginates near the forebrain, but no lens forms. If the cup reaches the surface a lens is produced. Such eyes are abnormally small. In a number of cases the lens came from the cup and not from the surface ectoderm.

CONGENITAL AND SENILE CHANGES.—**Streiff** describes several types of globe correlated with orbital development. Some eyes show a straightening of the corneal limbus in the nasal or temporal quadrant. Usually the border of the lower lid is tangent to the lower limbus. High standing eyes are combined with a relatively low orbital roof. A higher degree of astigmatism exists on the side corresponding to the lower orbital roof.

Hinnen has examined the healthy eyes of 462 persons with the slit lamp microscope, with reference to senile changes. In 57 children between 6 and 10 years of age, he found no pinguecula; between 11 and 20 years, *pinguecula* occurred in 13 cases, and its incidence steadily increased with age until it was invariably present in persons from 87 to 90 years of age. Its symmetric location and binocular occurrence are striking in the old. *Arcus senilis* was found in every case after 50 and was always bilateral. Senile changes occurred likewise in the iris stroma, pupillary margin and the retinal pigment layer, being found in increasing numbers with advancing age. Senile *alopecia* and canities occur similarly. Senile changes in the conjunctiva bulbi, cornea and iris are coordinated with senile changes in the lens.

HEREDITARY BLINDNESS.—The commission on hereditary blindness of the A. M. A., after discussing literature, frequency and cost of hereditary blindness, proposes that the best measure now practicable is to force contracting parties to a marriage to give bond that defective offspring of such marriage shall not become public charges. They advise that ophthalmologists keep better case histories, and that clergymen, medical societies, legislators and educators should study eugenics.

SPECIMENS AND TECHNIC. — The Museum of the Surgeon General's Library is providing for specimens sent by members of the national societies interested in ophthalmology and otolaryngology, and a valuable material is being accumulated there.

Eggston recommends mercurochrome 220 as a substitute for eosin, finding it more uniform in staining properties in 0.25% solution, more stable and more rapid in its action. In staining sections he uses it only for 1/2 minute to avoid overstaining. He recommends it also for blood cells in the Wright method and as a counterstain in the Gram method.

Knusel and **von Willer** use neutral red as a vital stain, instilling one drop of a 1% aqueous solution into the conjunctival sac. The details of the epithelium are clearly visible. No harm comes from its repeated use, and vision is unimpaired. It appears to be rapidly absorbed, none passing into the nose.

MISCELLANEOUS.—The contribution of **von Hippel** to the pathologic anatomy of certain rare eye diseases reports the histology of a case of episcleritis, scleritis and uveitis, and also of a case of a gumma of the ciliary body. In discussing the prevention of diagnostic and therapeutic errors, **Igersheimer** directs attention to the toxic lesions of the choroid, retina and optic nerve.

Ocular Lesions of General Diseases

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NEW YORK.

This review of the subject includes the literature from October, 1921, to October, 1922. For previous references see Ophthalmic Literature, vol. 17, 1921, p. 448.

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DIGEST OF THE LITERATURE.

SMALLPOX.—**Smith** reports four cases of *disciform keratitis,* three of which followed attacks of smallpox, and one following slight trauma to cornea. The corneal lesion appeared only after a delay of two months following the systemic disease in all three of the cases. The first appearance of the eye condition suggested interstitial keratitis of the ordinary form. In two of the cases sloughing ulceration followed, necessitating enucleation. Question is raised whether during attack of the systemic disease there may have been a slight corneal traumatism, altho no evidence to support such a belief could be found.

Decker, in a paper concerning the eye complications of variola, recalls that thirty-eight to seventy-eight per cent of eye complications involve the cornea, and are manifest from the twelfth to fourteenth day. In a report of two cases, the interesting feature of one was that the eye symptoms began and reached their climax before the time of the first appearance of the skin eruption; the second case was believed unusual because ulceration of cornea appeared six weeks after first eye symptom (explained by a latent suppuration of a smallpox lesion).

DIPHTHERIA.—**Poulard** in writing on diphtheritic paralysis of accommodation discusses the characteristic associated symptoms of the disease. He refers to a good prognosis in these cases.

Two cases of *gangrene of the eyelid* in infants due to the diphtheria bacillus are reported by **Weinberg.** The condition was noted immediately after birth in both instances, the inner canthus affected in one, the outer in the other. Diphtheria bacillus was isolated from both cases. In one case general diphtheria developed. Both cleared up under serum treatment without causing serious defect. Three similar cases are cited in the literature. All five cases occurred in infants, a skin lesion being observed soon after birth, later developing into gangrene. This suggests that the vaginal secretions of the mother during birth must be the source of infection.

In a paper discussing eye complications of the diseases of childhood, **Peabody** refers especially to albuminuric retinitis and optic atrophy in *scarlet fever;* the conjunctivitis and ulcer of *measles;* the conjunctivitis and paralysis of accommodation and of the extrinsic muscles in diphtheria; common ocular symptoms of mumps; and hemorrhagic involvement *in whooping cough.* A case of blindness, permanent in one eye, following whooping cough is reported.

ERYSIPELAS.—A paper on the ocular complications of facial erysipelas is presented by **Prélat.** He refers to the inflammatory edema and phlyctenular involvement of the lids; circumscribed *phlegmon of the lids,* with subsequent ectropion or entropion; also diffuse phlegmon of the eyelid, even total destruction of the lid thru gangrene. Lacrimal glands may be attacked; also dacryocystitis may supervene. Phlegmon of the orbit is discussed as a fairly frequent complication, which may lead the infection to meninges; optic atrophy, retinal hemorrhage and thrombosis may complicate. Lesions of the cornea are frequently noted.

Carrere and **Pagès** report the case of a man, aged 72 years, who presented, on the ninth day of a facial erysipelas, an amaurosis of the left eye. It was also chemotic and slightly proptosed. Ophthalmoscopic examination showed a choked disc, which in three days progressed to complete optic atrophy. In addition, the eye showed an exudative iridocyclitis and permanent corneal anesthesia. Both local and general conditions were greatly ameliorated by autovaccinotherapy.

MALARIA.—Malaria as a complication in eye, nose and throat infections is emphasized by **Searcy**, who reports eighteen cases which show the importance of careful systemic analysis and examination in order to meet the requirements of special local and general treatment.

Dudgeon reports a case of malignant malaria. Symptoms of headache, which increased in severity, drowsiness, followed by failing vision rapidly increasing. Patient died in thirty-six hours. Postmortem examination.

Wessely and **Horovitz** measured intraocular tension and blood pressure during a febrile attack in three malarial patients, and during the febrile reaction to milk injections in three patients with keratitis or iritis but otherwise normal. In all the cases it was found that as the temperature rose the blood pressure fell, and simultaneously the intraocular tension was also reduced. Graphically the curve of the *intraocular tension* followed that of the blood pressure with remarkable similarity. Both reached the lowest point when the temperature curve was highest. The cases cited are only illustrative of a number of other cases in which the findings were similar. In fever, therefore, the general blood pressure is the controlling factor in regulating the intraocular tension rather than any vasomotor changes in the ocular blood vessels.

MIGRAIN.—**Marin Amat** reports a case of ophthalmoplegic migrain, followed by a sensory and a motor ophthalmoplegia of the same side, and by optic atrophy of the other side, with fatal termination. The disease presents four periods with varying predominance of the elements of pain and oculomuscular paralysis, which he describes in some detail.

The case reported is typical, in a young woman of 29 yrs., married, previously healthy and mother of one healthy child. Patient during five years had three pain periods, after which irreparable lesions were apparent; (1) total paralysis of the third pair and concentric reduction of field on affected side; (2) double optic atrophy and total paralysis of third, fourth, fifth, sixth and seventh cranial nerves, with lethargy and loss of memory; (3) circulatory and cardiac lesions, anasarca, and death.

A case of permanent homonymous hemianopsia following an attack of migrain is reported by **Wiener.** **Suker** reports a case of migrain with serous *meningitis* (Quincke's type) and marked bilateral *choked disc.* Vision= 20/16 in each eye, fields for form and color concentrically contracted, and moderate secondary optic atrophy, after subsidence of the meningitis. A return of the meningitis occurred with reappearance of choked discs, and after convalescence vision again normal and fields same. Being a migrain patient, with marked gastric disturbance and choked discs, it was at first thought to be a case of brain tumor.

BOTULISM.—**Colver** writes on botulism, emphasizing its recognition as important to ophthalmologist and laryngologist. He has seen cases variously affecting the third, fourth, sixth and seventh, the vestibular nuclei of the eighth, the ninth and the twelfth cranial nerves. Botulism is essentially a toxic encephalitis affecting the nuclei of the pons and medulla and with rapid course, whereas endemic encephalitis is an infective process affecting the cortex, the meninges or the basal ganglia of the upper cranial nerves, and with more deliberate course.

TETANY.—**Ochsenius** reports an attack of tetany in a child. Tapping the facial nerve with the finger brought on a severe eclamptic attack. In the course of this attack there was a marked horseshoe shaped sinking in of the cornea, which was so decided that the mother noticed it. This change in the cornea disappeared as soon as the attack ceased. The author has not found any similar case reported and cannot explain the symptom.

ENCEPHALITIS LETHARGICA.—**Bab** reports in a case of encephalitis lethargica the psychogenous components of the diplopia. The patient had paresis of the right abducens. A psychic complication was the appearance of colored double images when no colored glass had been used for testing and a continual change had been made in the images. *Diplopia,* which gave great annoyance to the patient in spite of the lethargy, disappeared after five days time. He does not regard the symptom as an hallucination.

Foster writes on the ocular symptoms of epidemic encephalitis, and presents two cases in detail. He is interested in the.study with reference to the grouping of symptoms in individual cases. In the study of twenty-four cases, **Ronchetti** observed the following eye symptoms: frequently nystagmus, rarely disturbance of the light reflexes but frequent disturbance of the accommodation reflex, rarely anisocoria, occasionally slight venous stasis at the disc.

Two cases, of ten studied by **Bregazzi,** were noteworthy from an ocular standpoint. In one, there was diplopia, anisorcoria; paresis of *accommodation* with very lively pupillary reflexes. On attempts to accommodate, the letters moved further away, became larger and indistinct. He could read only by spelling the words. In the other case, there was bilateral *ptosis* and slight divergence. There was complete paralysis of ocular movement. Attempts at voluntary movement of the eyes caused only spasmodic movements of the orbicularis. But if the head was quickly moved to either side, the eyes turned to the opposite side.

Pupils were of the same size and reacted promptly to light; convergence reaction could not be elicited on account of absence of convergence. Vision greatly disturbed; projection uncertain; at 1/2 meter fingers could be counted and the physician recognized, but patient quickly became tired and vision completely lost. Soon there was conjugate deviation to the right, with central scotoma. However, vision returned to normal gradually, as did the fields, but at the time of reporting the case there was still paralysis of accommodation and some paresis of movement of the eyes. Author explains the condition by assuming multiple foci of disease of the brain with a very severe retrobulbar toxic neuritis. **Vedel, Giraud,** and **Oliver** report a case, aged 24 yrs., showing among other symptoms inequality and irregularity of the pupils, loss of reflexes of pupil to light and accommodation, and paralysis of accommoda tion. The reflexes reappeared during the third week, and at the end of the sixth week there existed only a slight inequality of the pupils with paresis of the reflexes.

Cerise writes on the ocular sequelae of epidemic encephalitis and remarks on the rarity of optic nerve affection in the disease; a few instances are known of scotoma and blanching of the papillae. Author cites three clinicians who have reported a few cases of bilateral complete atrophy of the optic nerve. Motor disturbance range from mere insufficiency of convergence to intense Parkinsonian symptoms, and are frequently permanent if they survive the acute stage of the disease. Persistence of these symptoms breeds nervous and mental disorders.

Krambach also discusses the permanent symptoms and amyostatic condition after encephalitis; and **Danadschueff** has pointed out the importance of recognition and management of the sequelae of the disease. Encephalitis lethargica and its ocular manifestations are the subject of papers and reports by **Marin Amat, Häfner, Arlt** and **Lenz, Cords, Hall, Bregazzi,** and **Holstroem.**

Doerr and **Schnabel** have demonstrated by animal experiments, that if rabbits are inoculated with the virus of *herpes* corneae, they not only show the typical lesions of the cornea but also certain general symptoms, especially of the central nervous system. Also that the virus can be transmitted from the brain of such infected animals directly to the central nervous system, or also to the cornea of other animals (rabbits and guinea pigs). If animals are injected intravenously with this virus, the lesions occur in the cornea, showing that this virus has a special affinity for corneal tissue.

After several unsuccessful attempts, the authors were finally successful in infecting a rabbit by subdural injection of the cerebrospinal fluid from a patient with epidemic encephalitis lethargica; five days after the injection the rabbit developed symptoms and died within twenty-four hours. From this animal, numerous animal passages of the virus were successfully made,—not only in rabbits, but also in guinea pigs and white mice.

It was found also the cornea of rabbits could be infected with material from the brain of rabbits infected with the encephalitis virus. It was further found that rabbits that had recovered from an infection with the herpes corneae virus were immune to the encephalitis virus, and rabbits in which the cornea had been infected with encephalitis virus were immune to the virus of herpes. The authors are not yet prepared to draw definite conclusions that the two viruses are identical. It is possible that the two are closely allied—one tending to localize in the central nervous system and the other in the cornea, as is indicated by the fact that in experimental animals the virus of herpes may become localized in the central nervous system. **Bourges** and **Marcandier** write on treatment of epidemic encephalitis.

INFLUENZA.—**Danco** reports a case of bilateral *neuroretinitis* stellata centralis, following influenza in a thirteen year old boy. Cerebrospinal fluid was under pressure. No renal involvement. Diminished knee jerks only sign of involvement of central nervous system. Retinal stellate figures covering the bloodvessels at the periphery was a noticeable feature. After sixteen months vision improved. **Aitken** reports a case of blindness following influenza several years before, which was accounted for by paralysis of accommodation. Patient, however, tho led into the office, was able to walk out unassisted after being instructed that lenses were unnecessary, only a slight error of refraction being present, vision normal. In addition to unimportant external diseases such as conjunctivitis, dacryoadenitis, etc., **Waldmann** observed *metastatic ophthalmia,* which always caused atrophy or phthisis bulbi, vitreous hemorrhage, retrobulbar optic neuritis, paralysis of internal and external eye muscles, and glaucoma.

Hartman reports an unusual form of *keratitis profunda* following influenza, in which there was a deep, centrally placed, discoid infiltration, which after suppuration perforated thru the external surface of the cornea. He refers to Pfluger's classification of keratitis profunda postinfluenza into; 1st, those of typical keratitis parenchymatosa; 2nd, those resembling keratitis nummularis; and 3rd, those resembling clinically the author's case.

SCROFULA.—**Steiner,** thru his experience as ophthalmologist in Java, has seen few cases of scrofula, altho there are many and very severe cases of pulmonary tuberculosis in Java. Scrofulous eye diseases are extremely rare, tho very frequent in Europe. He does not regard nourishment or hygiene as important a factor in the absence of the disease as the airiness of the dwellings (bamboo lattice work) and the clothing, which on account of the hot climate, permits ready circulation of air. **Mans** reports fifty cases of severe *phlyctenular conjunctivitis* treated by intragluteal injections of cow's milk, which had been boiled three minutes. All were favorably influenced. Caseosan and aolan had no better action. The dose varied from 1 cc. in nurslings to 6 cc. at the age of twelve years, and 10 cc. in adults. Higher the rise of temperature, up to 102.2, better the result. Abscess, chill and shock did not occur.

TUBERCULOSIS.—**Magruder** analyzes the asthenopic symptoms shown in 180 tuberculous soldiers and four young women, in whom a positive diagnosis of tuberculosis had been made. He defines *asthenopia,* following Jackson's and Donders' observations, and finds that in tuberculous subjects whose whole system is affected by the toxins of tuberculosis, there is the common complaint of blurred vision on sustained close work, the time varying from five minutes to half hour; this accompanied or followed by headache and pain in the eyes; a few complain of photophobia, lacrimation and epiphora.

Neame reports a case of tuberculosis of conjunctiva of right eye. Left eye of the patient became useless within six weeks after an occasion when, on stooping at work, he felt something give way in the eye. Later cough developed and persisted. Glandular swelling in the neck and tearing of right eye began. Iridocyclitis of left eye, cornea hazy; anterior chamber full of whitish substance; conjunctiva negative with regard to tubercles. Excision of conjunctiva of right eye showed fairly typical tubercle formation, two or three fairly well defined tubercles, with giant and round cells, epithelioid cells and much fibrous tissue.

Ocular tuberculosis is the subject of a paper by **Leech.** *Sclerokeratitis* is the most frequent manifestation in the author's experience, less frequently sclerosing keratitis. He regards a case of monocular retinal hemorrhage in a young adult, with no cardiorenal disease and a negative Wassermann, as being one most probably of retinal tuberculosis. Recurrent vitreous hemorrhages in young adults are undoubtedly of tuberculous origin. Tuberculin treatment tends to prevent recurrent attacks of tubercular exudative choroiditis. The ocular manifestations of tuberculosis is the subject of articles by **Schieck, Igersheimer, Schlossberger, and Stark.**

Poyales thinks tuberculosis of the eye occurring in childhood has been insufficiently studied, especially from viewpoint of histology. Tuberculosis should always be suspected when treatment of acute or chronic process is not followed by improvement, other infections being eliminated as far as possible. Author reports three cases in which grave lesions required enucleation. Minute description of the histology of the enucleated eyes is given, with plates in illustration. Pirquet's test was negative in one case, but the author believes the test should always be made provided no definite contraindication is present. The eye should be enucleated when no vision is present. The article is illustrated by eighteen plates.

Stilwill describes a case of destructive tuberculosis in the eye of a child. A boy, aged four years, with negative personal history and negative family history, presented a typical low grade but acute plastic iritis of the right eye, with grayish white deposits in stroma of the iris near pupillary margin, small bloodvessels passing in and about them. In three weeks sclera near limbus on nasal side became bluish in color, an ectasia three to four millimeters presenting. No pain or discomfort. Enucleation. Microscopic examination evidenced tuberculosis of the ciliary body, with extension thru the globe.

Block reports a case of posttraumatic tuberculosis of the eye. The cornea was injured by an iron splinter, followed by iritis with hypopyon, posterior synechia, and positive reaction to ocular tuberculosis. Healing followed tuberculin therapy. No analogous case has been described in literature. The author explains the mild course of the tubercular iridocyclitis by the fact that the bacilli are carried by the blood current, which enables the body to elaborate protective substances more rapidly, and by the peculiar conditions of nutrition and pressure within the eyeball. Block also reports the case of man, aged 43 years, with rheumatism of the right knee in 1915, in 1917 a severe inflammation of the left eye which soon subsided under aspirin and drops. April, 1919, the right eye was injured by a piece of glowing iron. Diffuse opacity of cornea, hypopyon, pupillary margin adherent to capsule of the lens. Vision — perception of movement of hand. Iris showed a small tear; June 30, hypopyon was absorbed. July 4, intense local and general reaction to old tuberculin. After the treatment with new tuberculin and blue radiation, extraction of lens. Nov. 20, vision with correction = 5/15. No analogous case has been described in the literature.

In a paper on industrial *trauma* in relation to the developement of ocular tuberculosis, syphilis and neoplasm, **Barkan** reports three cases in which trauma, its character and time relation to the appearance of the interstitial keratitis leads him to believe that the trauma was the provocative agent. In the first two weeks after injury an iritis can only be definitely established as a tuberculous one if actual tubercles appear. The relation between trauma and malignant disease is not so easily followed or differentiated, and the author quotes Fuchs' estimate that among 259 choroidal sarcomas, eleven percent might have been traumatic in origin. Several case histories are given to illustrate the difficulty of deciding with any degree of certainty as to the effect of industrial trauma.

Ocular tuberculosis, according to **Schieck** is an expression, with very few exceptions, of hematogenous tuberculous metastases. In most cases it can be demonstrated, that in some part of the body there is a focus of preexisting tuberculosis, especially in the lymph nodes at the pulmonary hilus. Depending upon the degree of immunity, Ranke distinguishes three different stages of tuberculous infection, primary, secondary, and tertiary. The first is the result of contact with the tubercle bacillus; the second, an expression of oversusceptibility (stage of anaphylaxis); and third, the infection having been overcome (stage of immunity). We expect to find the last two types, and also the first, in tuberculous affections of the eyes. The success or failure of treatment with tuberculin will depend on which stage of the disease exists when the treatment is begun.

Rist presents a paper on the extrapulmonary localizations of tuberculosis, their pathogenic interpretation and their reactions to tuberculin. These localizations are numerous, since there is hardly an organ or tissue where they may not be; but in a given individual they are not usually multiple. Ordinarily it occurs as an accidental, isolated, limited happening in health, a manifestation of the disease up until then ignored. In all cases of intraocular tuberculosis, the calcifications of primary intrapulmonary inoculation may be shown by X-rays, altho there may be no sign of active pulmonary tuberculosis.

Considering the action of *tuberculin*, the author states that the three modes of reaction have undergone diverse fortunes. General reaction is employed almost exclusively in veterinary medicine. Focal reaction is dangerous in aggravating a torpid pulmonary lesion. As to the local reaction, von Pirquet has given it great importance. Tuberculin therapy by the modern formula, in avoiding a focal reaction, is deprived of its efficacious element. Focal reaction is followed by undeniable success, but its danger in aggravating existing pulmonary lesions must be recognized. It is necessary to fully understand the place that tuberculin should occupy; that place is scientifically immense, but practically very modest.

Landenberger makes a comparative study of human and bovine cutaneous reactions in cases of *scrofuloderma*. and concludes that bovine tuberculin is not more delicate than human tuberculin when used in Pirquet skin tests. In cases of scrofuloderma, one cannot tell whether the etiologic factor is the human or the bovine tubercle bacillus. Reactions on 165 cases of scrofuloderma complicated by phlyctenular diseases of the eye showed that in the more serious cases the bovine reaction was more prominent than that caused by the old tuberculin.

Weigelin reports his experience in 77 cases of ocular tuberculosis, observed over a period of from three to fifteen years; iritis serosa with chronic iridocyclitis without typical tuberculous signs 27; disseminated choroiditis 16; typical tuberculosis of iris, nodular iritis, granuloma of iris and ciliary body, choroidal tubercles, 22; tuberculous keratoiritis. scleritis and severe forms of *keratoconjunctivitis* eczematosa on tuberculous basis 12: one case of pure parenchymatous keratitis. The treatment started with 1/1000 mg. old tuberculin. increased every two or three days by 1/1000, then 1/LL, finally 1/10, until 1 mg. or several were tolerated without irritation, and lasted from three to four months. In very intense opacities of the vitreous it was very successfully combined with subconjunctival injections of salt solutions from two to four percent. In very severe cases the resultless tuberculin treatment was replaced by cautious mercurial inunctions, generally also without success.

In most cases transient improvement was attained, without prevention of relapses, especially in affections without typical signs. The effect was noticeable in very severe cases, which after unsuccessful treatment, showed a remarkable change under the specific cure. Some cases, which became blind, showed that tuberculin may be without any effect. An attempt with tuberculin seems justified in all cases of ocular tuberculosis, with frequent repetitions, as by cautious application no harm is done.

Nowak outlines the *tuberculin treatment* of eye diseases as it is carried out at the clinic in Vienna. For diagnostic purpose, old tuberculin subcutaneously in doses of 0.2 mg., 0.5 mg., 2.0 mg., 5 mg., 10 mg., at intervals of two days. The puncture reaction occurs most frequently, less often the general reaction, and very seldom the focal reaction.

In treatment, bacteria emulsion is used, beginning with 0.001 mg., and never increased more than fifty percent of the previous dose. At first injections are given every second day (up to 1 mg.), then every third and fourth day (up to 10 mg.), 1 mg. is the absolute maximum dose. The maximum dose when reached should be steadily prolonged, but at longer intervals (8, 10, 12, 15 up to 28 days). Small doses are given in the upper arm, large doses in the back. Temperature is taken four times a day. Patient is weighed every two weeks. If temperature rises over 37 degrees C., the dose is repeated, or the interval prolonged. If temperature continues, injections are discontinued eight to fourteen days. Doses are reduced when there is loss of weight. If focal reaction occurs during treatment, injections are discontinued for one to four weeks, and when treatment is resumed the dose must be reduced to 1/10 to 1/100 of the last dose. At times large doses cannot be given because of focal reactions.

Meller recommends that tuberculin treatment of eye disease should be carried out by the practical physician, because it cannot be employed in a hospital for such a long period of time as it requires, and it is more wisely administered thus in conjunction with general treatment and hygiene of the patient, than by the oculist. It is just as important that these cases be treated after acute exacerbation of the disease, because of the tendency to recurrence, and the therapy may cause a resorption of even stationary inflammation products.

The value of practical use of *light treatment* in tuberculous eye diseases is the subject of a paper by **Passow,** in which he calls attention to irradiation with the Bach quartz lamp of a diseased focus in the eye, at the same time irradiation of the whole body, the selection of certain dosage of the quantity of light for general and local irradiation being especially outlined. Importance of a standard method of measurement for the objective determination of the quantity of light is shown. He refers to the Furstenaw actinometer. The Bach quartz lamp can be used with great success for general irradiation in scrofula, and for local irradiation in external tuberculous lesions.

Nowak publishes his observations of the partigen test and the Deycke-Much treatment of tuberculosis of the eye. Tests were performed on two hundred individuals. Out of twenty-four with negative tests, thirteen were given the bacillus emulsion, with good results in six cases. The results are inexplicable if a negative test means absence of tuberculosis or an anergic condition.

Ninety-six tuberculous affections were treated according to the method of Deycke-Much; thirty-eight were cured, thirty-two considerably improved, four grew worse. Relapses were very common. Out of nineteen serious cases, only two were cured, and three improved. Results are not so good as from bacillus emulsion. For purpose of comparison in sixty-two cases, each was treated with the two remedies. Number of relapses was much less with the emulsion. He concludes that no advantage can be attributed to partial antigen over bacillus emulsion.

Krusius writes on ocular tuberculosis and acute immunization after Friedmann; **Grumbach** discusses the antigen of Besredka in ocular tuberculosis. Effect of tuberculin on the eye is the subject of an article by **Gonzalez.** **Darier** asks, "Is tuberculin a failure," making pointed comparisons and referring to illustrations in point.

SYPHILIS.—**Blatt** writes of his clinical experience in the observation of eyeground manifestations due to advanced lues as it occurs in Bosnia. It is noteworthy that retinochoroidal changes occur usually in the secondary stages or shortly after the initial infection. Optic nerve involvement is rare. In Central Europe advanced lues manifests itself by ulcerous and gummatous lesions of the skin, bones and muscles, whereas *neurosyphilis* is rare. This is said to be due to the mode of life and the level of civilization, that primitive country people and races living under little nervous tension are not so predisposed to neurosyphilis as those in the city, under strenuous mental exertion, alcoholism, etc.

Connective tissue proliferation is the dominant factor in the fundus changes. It occurs over the retinochoroidal foci, and spreads thru the vitreous lamellae and over the retinal surface, and from the disc margins follows the vessels in the form of striped, sinewy white bundles. The author refers to this picture as *"retinochoroiditis* fibrosa luetica".

Gifford discusses the ocular manifestations of syphilis which may give valuable information to the internist in the study of the disease. Interstitial keratitis definitely demonstrated is often of most importance; old choroiditis is a valuable indication; iritis with minute nodules, and fine dust like opacities in the vitreous are always significant; uveitis and extraocular paralysis are mentioned; Argyll Robertson pupil, slight inequalities of the pupils, and abnormalities in the light reaction. He refers to optic atrophy and the intraspinal treatment employed, also the injection of mercury bichlorid into the lateral ventricles by Suker and Schoenberg.

Clapp reports his experience and study of one hundred cases of acute *iritis,* in which he found syphilis to be the cause in eighty percent of the cases. Sixty-eight percent were negroes, and the diagnosis in some of the cases was made from the fact that recovery was rapid under antisyphilitic treatment. **Lauber** reports a case of fixation of the eyes by luetic *orbital necrosis.* **Meyers** in writing upon some eye points to be considered in syphilis, refers to those clearly defined ocular symptoms so commonly met with, so important in early diagnosis and in following the course of the disease. Ocular manifestations of syphilis is the subject of a paper by **Coutela.** **Urechia** and **Mihalescu** report a case of typical Friedrich's disease in a boy, aged sixteen, in whom the Wassermann reaction was strongly positive in the blood and cerebrospinal fluid. The patient had suffered from myopia since the age of eleven, and the pupils had been dilated past six years. Examination of the eyes showed the pupils to be unequal, dilated, slightly oval, not reacting to light; accommodation faulty; concentric diminution of the visual field, chiefly temporal; a slight congestion of the choroid.

The discussion on the diagnosis and treatment of *congenital syphilis* before the Royal Society of Medicine (London) is presented by **Doyne.** The subject matter, by Sir Humphrey Rolleston, deals with the limits of the Wassermann reaction as a means of diagnosis; also the influence of congenital syphilis, (a) in favoring the onset of other infections, (b) in leading to changes in the endocrin glands and so indirectly to syndromes which are not necessarily specific, and (c) in relation to diseases or syndromes which are not generally regarded as due to syphilis, and are not obviously secondary to lesions of the endocrin glands. Other phases of the subject are discussed by other members of the Society.

Kraupa insists upon distinguishing between disease manifestations of congenital lues and the stigmas of luetic injury of the fetus. The following stigmas are discussed: marked frontal eminences (olympic forehead), half moon profile, wide bridged nose, Hutchinson's teeth, pointed upper incisors, high palate, rhagades, anomalies of the hair and skin, earthy hue of the face, etc.

The relation to *hereditary lues* to the following ocular affections is pointed out: vertically oval cornea, ribbon shaped opacities of cornea, keratoconus, hydrophthalmos, scrofulous eye diseases—these are mostly manifestations of congenital lues, even a positive tuberculin reaction not proving their specificity. Sympathetic ophthalmia, myopia, retinal detachment, glaucoma and zonular cataract are discussed in this connection. Author recommends by way of treatment iodin and, for vascular crises, papaverin and benzols, which should always be given in acute glaucoma and before operations on arteriosclerotics.

Kubik reports the case of an infant, aged seven weeks, with the clinically well defined picture of syphilitic *conjunctivitis*: Dense, more or less pale swelling of the ocular conjunctiva, owing to diffuse infiltration with lymphocytes and leucocytes and plasma cells, and proliferation of connective tissue, similar to edema. The conjunctival tarsi showed a peculiar pale yellowish swelling with intact smooth surface, no papules or papulous gummatous changes. After thoro irrigation a smear from the epithelium of the tarsus revealed in dark field illumination numerous moving spirochetae. During the three days the patient stayed at the hospital, conjunctival affection remained the same under mercurial inunctions, while the associated parenchymatous keratitis and iridocyclitis, of the early occurrence of which only a few observations exist, increased in intensity.

In the study of the diagnostic significance of examinations of cerebrospinal fluid in syphilitic disease of the eye, **Blatt** finds a remarkable agreement between cases in literature and his own, in which the *Wassermann reaction* is carried out with that of the *spinal fluid*. 164 cases are divided into five groups, according to diagnostic variety: (1) Diseases of the membranes (sclerosis of lids, keratitis, iritis, choroiditis) of which twenty-three gave negative reaction, six positive, four uncertain. (2) Lesions of optic nerve, thirty-eight positive, six negative. (3) Lesions of nerves supplying muscles of eye, thirteen positive, five negative. (4) Pupillary alterations. (5) Disturbance of visual field without other objective symptoms.

Positive test of spinal fluid not only confirms the diagnosis of a nerve affection of the eye, but may contribute much to a localization of lesions of either central or peripheral nervous system causing eye symptoms.

Fuchs, in a study of the cerebrospinal fluid and changes in the optic nerve in syphilis, examined 84 syphilitics with positive cerebrospinal fluid, and found the optic nerves involved in 13. Six of 46 patients, who had been syphilitic more than two years, had papillitis with normal vision. In two cases of recent syphilis there was an optic *neuritis* and negative cerebrospinal fluid. He found all manner of defects in the visual fields, and variations in the vision did not correspond with the nerve involvement (papillitis). **Dujardin** and **Rasquin** have made clinical and serologic examinations of 265 patients with irregular pupils and found syphilis present in 70 per cent. In some of these patients the irregular pupil was the only manifestation of syphilis. **Kyrle** points out the rather large proportion of cases of tabes in which the Wassermann reaction of the spinal fluid was found negative. In some series it has amounted to over 50%. This is important to the ophthalmologist who is likely to see cases at an early stage in their progress. He reports five such cases, in all of which there was clear evidence of syphilis actively treated.

A further report on the *Wassermann test* at the Missouri School for the Blind is published by **Lamb.** Of 189 scholars, tests were made on 155; in

19 of these syphilis is of evident etiologic significance. A table of diagnostic causes in which the Wassermann results occurred shows: retinochoroiditis 5 cases, 5 positive; parenchymatous keratitis 3 cases, 1 negative, 2 positive; optic atrophy 25 cases, 5 declined test, 12 negative, 8 positive; progressive uveitis 10 cases, 9 negative, 1 positive; congenital malformations 26 cases, 5 declining test, 19 negative, 2 positive.

In the treatment of eye conditions, **Garraghan** believes the possibility of syphilis should always be kept in mind. He makes it a routine to have a Wassermann test made in all eye diseases and injuries. He reports two instances of insignificant injury in which a positive Wassermann reaction lead to prompt relief of what may have been serious complications. **Bolten** describes some cases of unmistakable incipient tabes in which none of the four specific tests of spinal fluid or tests of the blood elicited a positive reaction. Among other symptoms occurred isolated paralysis of ocular muscles, beginning optic atrophy, sluggish pupil reactions, etc.

In cases of ocular complications observed after typhoid fever and influenza, **Torres Estrada** frequently encountered evidence of previous syphilis. He reports 18 cases of this character, 9 following typhoid and 9 following influenza. In some of them antisyphilitic treatment brought about great improvement. In 7 the syphilis was hereditary, and in two others probably so, while in only 4 was it clearly acquired and in one other probably acquired. The lesions encountered were atrophy of the optic nerve in 10; neuritis, 2; uveal inflammation, 2; and one each of retinitis, hemeralopia, chronic glaucoma and hemiplegia. The treatment of ocular syphilis is the title of a paper by **Bussy,** and **Gourfein** discusses the treatment of luetic affections by the tartro-bismuth of potassium and sodium.

The field of *experimental syphilis* has been approached by a few observers. In a paper concerning syphilis of the visual apparatus, **Igersheimer** studied fifty-four cases of experimental metastatic parenchymatous keratitis in the rabbit. In the first group, comprising acute inflammations, numerous spirochetes were found quite posteriorly in transparent cornea at a distance from the inflammatory focus. In one case abundant spirochetes were found limited to an enormous central mass of lymphocytes. A third group exhibited connective tissue formations situated quite posteriorly, often with ruptures of Descemet's membrane, and containing large quantities of spirochetes. The keratitis was treated by injection of salvarsan preparation into anterior chamber. In 18 cases the treatment was successful, one case being confirmed microscopically. In 2 cases the results were doubtful.

Brown and **Pearce** have recorded numerous affections of the eyes occurring in their experimental work on syphilis in the rabbit. Scrotal or testicular inoculations of the Treponema pallidum were followed by conjunctivitis, keratitis and iritis, the lesions usually arising from a common focus located in the episcleral tissue about the cornea, from which the infection spread to conjunctiva, thence to ciliary body, iris and the choroid. Most of these eye affections occupied a definite position in the scheme of tissue reactions, being the only generalized lesion developed or the last type of lesion to appear. These facts together with the unusual frequency of relapse in these affections, are believed to indicate that a low degree of protection was conferred upon these tissues by reactions taking place elsewhere, and that the protection afforded by the local reaction was of a feeble character. This deduction is in part confirmed by the fact that it was found to be possible to increase or decrease the incidence of eye lesions by the use of experimental means, which varied the scheme of reaction in animals inoculated with a given strain of Treponema pallidum.

Lauterstein and **Planner** report on the intracutaneous injection of organluetin devised by Fischer, an extract of the lungs affected with pneumonia alba of hereditary luetic fetuses, which contain abundant spirochetae, and also of the liver, spleen and glands. It was employed in 112 cases. Out of 45 cases of parenchymatous keratitis of hereditary lues, 36 reacted typically positive, while only 26 gave a positive Wassermann. The results in ocular affections coincided with those obtained in other spirochetic affections. The reaction failed in secondary luetic and metaluetic processes.

A focal reaction was observed in a boy, aged 4 1/2, with *parenchymatous keratitis,* in whom the following day hypopon developed, and the previously negative Wassermann reaction turned positive. Positive reaction was found in all luetic eye affections, regularly in recent parenchymatous keratitis, less frequently after they had run their course. In these cases it is more sensitive than the Wassermann. By its frequency in recent parenchymatous keratitis, and its constant lacking in other forms of deep seated keratitis, it has high differential diagnostic value.

Gebb reports, that in 200 eye cases in which he compared the Sachs-Georgi reaction with the Wassermann reaction, he found a lack of agreement in the two tests in 4 per cent of the cases. And in this 4 per cent, the Sachs-Georgi reaction was not necessarily at fault. With his modification of the Sachs-Georgi test, keeping the serum in the incubator for twenty-four instead of two hours, Gebb is convinced that the reaction is as truly specific as the Wassermann reaction, which is known to be negative in certain cases of syphilis.

LEPROSY.—**Maucione** presents a paper entitled a clinical, anatomic and therapeutic contribution to the study of leprosy. He reports five cases in great detail. Enucleation of one eye was necessary in two cases, and in two others large nodules were excised, which had developed from the episclera near the limbus with invasion of the cornea. In two cases medical treatment was carried out with great benefit, in the form of injections of sodium cacodylat in large doses. At first 50 per cent solutions was employed, later the solution was increased to 100 per cent. The author claims unquestionable cures in the two cases and recommends its thoro investigation. **Muir** writes on eye affections in leprosy.

DIABETES.—**Marin Amat** presents the ocular manifestations in a case of diabetes insipidus of hypophyseal origin. Diabetes insipidus is admittedly due to *hypophyseal insufficiency.* Partial or total increase in volume compresses the optic chiasm and raises intracranial pressure. The author discusses the theory in detail and reports the case of a man, 29 years, in whom there was postneuritic atrophy of both papillas, especially the right. Treatment with pituitrin caused reduction of the urine from 8 liters to 4 liters per 24 hours, and yielded some improvement of vision.

In a paper on diabetes mellitus from the ophthalmologist's standpoint, **Weisser** refers to *cataract* as affecting both eyes with equal frequency; in the aged the prognosis is more favorable, because having built up the system and eliminating sugar as far as possible, and with an absence of acetone and diacetic acid, opportunity for extraction of the lens satisfactorily is afforded. He also refers to *retinitis* and hemorrhage, and notes changes in accommodation consist of diminution in the range rather than a complete paralysis. Changes in refraction are quite common. Diplopia and ptosis, iritis, cyclitis and corneal suppuration are also discussed.

Terrien, in a paper on the minor ocular signs of diabetes, states that ocular complications are found in 10 percent of the cases. The importance of recognizing the minor ocular signs, such as changes in refraction and accommodation, is evident, because it may lead to an early diagnosis. *Presbyopia* occurs much earlier than normally and requires frequent changes; also it may appear suddenly within a few days. This is due to general loss of muscular strength, thereby affecting the ciliary muscle. Hyperopes are similarly affected, and the error (latent) may be thus suddenly revealed. Transient myopia frequently develops and is attributed to an increase in the refractive value of the lens, frequently just preceding cataractous change. Temporary myopia also occurs in other diseases, as in jaundice and various intoxications; 2 cases are reported (diarrhea and typhoid fever).

Pollot discusses the transient *changes of the refraction* of the eye in diabetes mellitus, and reports the case of a man, aged 34, who being myopic one and one-half diopters simultaneously with the onset of the disease, experienced improvement in his vision and was found to be emmetropic. After four weeks of treatment, one-half diopter was demonstrated after paralysis of accommodation. A year later his myopia had returned to one and one-half diopters. **Hagen** reports five cases of transitory hyperopia in diabetes. The hypermetropia seems to occur 8 or 9 days after patient has been placed on diet. It does not appear to be a complication of diabetes, as in cataract or retinitis, but rather a transitory change in the lens.

SCURVY.—**Blake** reports the ocular changes in a case of infantile scurvy. A child, aged 1 year, with the usual symptoms of *"rheumatism,"* presented an *exophthalmos* which subsided and recurred a second time. The author refers to the literature of the subject and the ocular changes commonly found, and emphasizes the definite means of diagnosis when one is familiar with the symptomatology of the disease.

ENDOCRIN DISEASE.—**Zentmayer** presents an analysis of the etiologic relation of the eye to the endocrin organs. Beneficial effect of glandular therapy, and the fact that oculomotor disturbances have been met with, not resulting from pressure, suggests that disturbed secretion of the pituitary may be a factor in the amblyopia of certain cases of undoubted hypophyseal disease. There is no constancy in the appearance of ocular symptoms in *hyperthyroidism;* they stand in no relation to the gravity of the toxemia. A symptom recently described by Suker is that of "deficient complementary fixation in lateral eye rotation."

In *myxedema,* edema of lids with consequent narrowing of the palpebral fissures is most marked ocular phenomenon; edges of lids are hyperemic, eyebrows are elevated, hairs and cilia are sparse and brittle. Subconjunctival hemorrhage may occur; lacrimation, asthenopia, neuroretinitis and superotemporal contraction of visual fields are met with. Oculocardiac reflex is found to be enormously intensified, due, according to Petzetakis, to the sympathetic being deprived of the normal stimulation of the thyroid. Author also discusses the etiologic relation of pigment degeneration of the retina, amaurotic family idiocy and recurrent retinal hemorrhages of adolescence to disturbance of the endocrin organs.

Kuepferle reviews the literature of the past few years dealing with internal secretions in general, their effect on the sympathetic system and blood pressure, with some reference to the eye, especially the eye symptoms of exophthalmic goiter.· **Fridenberg** describes the ocular manifestations and tendency in pituitary disturbances and in hyperthyroidism. He analyses symptom group or types, and gives in full the characteristics of the vagotonic tendency or reaction in pituitary involvement; also an outline of the thyroid type; and suggests means of treatment by careful refraction and correction of muscle imbalance, by administration of specific alkaloids indicated by the typical reactions, as well as by specific endocrin therapy.

Poyales describes the visual disturbances in Frölich's disease, and reports a case with a study of the visual disturbances in relation to the state of functional insufficiency of the hypophyseal gland, with signs of *dystrophia adiposis genitalis.* Symptoms are divided into two groups: (1) perihypophyseal symptomatology; (2) symptoms of functional dystrophy.

Functional alterations consist of: (a) alterations of monocular visual field; bitemporal hemianopsia is early and marked in 50 per cent of cases; homonymous hemianopsia occurs in 15 per cent of cases. (b) Modification of blind spot of Mariotte; this shows increase of absolute and negative scotoma zone in temporal half. (c) Disturbances of stereoscopic vision. (d) Alterations of binocular visual field. (e) Macular symptoms.

Organic lesions include: (1) lesions of fundus—optic neuritis and postneuritic optic atrophy. (2) Disturbances of intrinsic and extrinsic muscles of the eye. In 10 per cent of cases monocular paralysis of motor oculi exists.

Ocular changes in Basedow's disease are outlined and discussed by **Lindgren.** Adiposis-genital syndrome with ocular troubles is reported by **Bollack** and **Nida.**

Anders and **Jameson** present a statistical study of the relation of *acromegaly* to thyroid disease. A review of the literature is given. Two cases are reported in illustration. 215 collected cases of acromegaly are studied. A detailed tabulation of 91 cases in which thyroid disturbance was associated with acromegaly is given. Of 215 cases tabulated, 99 cases of pituitary lesions are mentioned, and in 68 cases thyroid changes occur. In 91 cases, combined acromegaly and thyroid disturbances are tabulated. 124 cases of acromegaly without thyroid disturbances are compared in a table. Also a table of the age by decades of acromegaly without thyroid disturbances, 109 cases, and acromegaly with thyroid disturbance, 86 cases. In summary, thyroid disturbance is frequent in cases of acromegaly, 33 per cent. Hypothyroidism is more commonly associated with acromegaly than hyperthroidism, and the combined cases are greatly improved by administration of thyroid preparations.

Santos Fernandez reports a case originally reported by **Couce** and **Poyales,** of a child 8 years old with acromegaly and gigantism. Wassermann test, von Pirquet, and urinalysis negative. Vision O. D. normal, O. S. = 0. Ophthalmoscope revealed normal fundus of right eye, atrophic nerve of left eye. Author believes the lesion due to hypertrophy of anterior lobe of pituitary. Treatment consisted of administration of pituitrin extract and removal of anterior lobe of the gland.

LEUKEMIA.—**Bab** writes on ocular changes in lymphatic leukemia; mentions hemorrhage into the lids, conjunctiva and vitreous; lymphomas in the lids, under conjunctiva and in the lacrimal gland; and leukemic retinitis; and reports a case of glandular enlargements in the neck and groin, fibrinous *iritis* with synechia and status glaucomatosis in right eye. Iridectomy was performed, and hypopyon formed, examination of which, on second iridectomy below, revealed exclusively a collection of lymphocytes. The aleukemic stage passed into the leukemic one, and patient died in a few weeks. Leukemic retinitis did not appear. Iritis in leukemia is very rare, according to Heine.

ADDISON'S DISEASE.—A case of *pigmentation* of the limbus corneae in Addison's disease is reported by **Meesmann.** The conjunctival discoloration at the limbus appeared as a ring 3 mm. broad. Radiating lymphatics at the limbus could be seen with the slit lamp to be dilated and their walls filled with pigment, newly formed lymphatics extending to the inner margin of the pigmentation. It is believed the pigment originated from the epithelial cells. New formed lymphatics are regarded as a reparatory process.

PSEUDOBLASTOMA.—**Marbaix** and **Van Duyse** report a case of pseudoblastoma of the orbit in a child, aged 11, with marked exophthalmos and limitation of movement in right eye. The condition had lasted for a year, and remained constant six months after examination. Repeated attacks of pain suggested orbital tumor. Krönlein's operation revealed thickening of the lacrimal gland, which was removed. Ocular condition was not modified by this procedure and ptosis became complete; pupil remained half dilated and cornea and conjunctiva insensitive.

Microscopic examination of the lacrimal gland revealed inflammatory lymphomatosis, and examination of the blood showed a distinct lymphocytosis. Tests for tuberculosis and syphilis had been negative. The author concludes that the "chronic inflammatory lymphomatosis" of the orbit may be the expression of a general lymphocytosis, and in diagnosing tumors of the orbit examination of the blood should always be made before operative interference is resorted to.

HEMORRHAGE.—**Terrien** writes on posthemorrhagic amaurosis and reports two cases. One case, a woman, 30 years, suffered profuse hemorrhage during confinement. Four months later presented partial optic atrophy. Vision O.D.=1/4; O. S. = 1/5. Fields were contracted and lower part of each field nearly lost. Second case, soldier, 24 years, severe leg injury. Four days after injury leg amputated because of gas gangrene. During improvement complained of reduced vision. Vision O. D. — fingers at 1.5 meter; O. S. — hand movements at few centimeters. Discs were hazy and margins indistinct. Fields greatly contracted, and inferior portion almost abolished.

Terrien admits the difficulties in the way of a pathologic explanation. If due directly to anemia, amaurosis should occur almost immediately after injury. He considers the presence of slight neuritis and the usual affection of the lower field of vision give a clue to the explanation. That is, that the effection starts with retinal anemia, which allows any toxin present to act more powerfully as it is less diluted, and that the superior part of the retina from the position of the head had a poorer blood supply. The rarity of such a condition in traumatic cases, as contrasted with their greater frequency in diseased conditions, lends support to his theory.

Amaurosis following traumatic hemorrhage is rare; it has been noted in a few cases in war wounds where hemorrhage had been considerable. It rarely occurs immediately after or during the hemorrhage, being noted in only 1/10 of the cases during hemorrhage, and in 1/10 of the cases immediately after hemorrhage. In 12 to 15 per cent of cases it developed in the first 12 to 24 hours after hemorrhage; in 20 per cent within 48 hours; and in 40 per cent in 3 to 10 days after. See also p. 390.

RENAL AND CARDIOVASCULAR DISEASE.—**Benedict** presents a study of retinitis of cardiovascular and of renal disease, in which he classifies retinitis of this type into four groups: (1) retinitis of acute nephritis; (2) retinitis of chronic hypertension and nephritis; (3) retinitis of arteriosclerosis; (4) retinitis of diabetes (somewhat dependent on arterial changes). He emphasizes the importance of differentiating between these types.

The most prominent factor in the production of retinitis of diseases of the vascular system and of nephritis is sclerosis of the retinal arteries, to which are added other features characteristic of the etiologic factor of the sclerosis. The chief reason for early differentiation of the retinal changes lies in the possibility of averting serious damage to the kidneys by continued high diastolic blood pressure, which produces arterial thickenings.

Gilbert states that inflammation of the anterior uvea and diseases of the retina are the two groups encountered in renal and vascular affections. In renal sclerosis disease of the anterior uvea is seen, and is based upon angiosclerotic process resulting in iridosclerosis. Small hemorrhages with fatty infiltration and severe hemorrhage of the fundus occur in arteriosclerosis and bear no etiologic relation to nephritic retinitis; in these cases inflammatory changes occur, which are due to metabolic disturbances resulting from nephritis.

Meyer and **Nassau** report, that in 35 cases of *idiopathic hemorrhage* into the skin and mucous membrane in young children, 114 attacks were observed; the ocular conjunctiva was involved 14 times. Hemorrhage in the conjunctiva occurred either in the form of hemorrhagic spots or streaks, in one case a diffuse hemorrhage in the conjunctiva occurred such as is observed in whooping cough, in one case lacrimation was tinged with blood. In three of the cases hemorrhage preceded an acute infectious disease. A study of these cases convinced the authors that they were associated with some nutritional deficiency and were best treated by a diet rich in vitamins.

In experiments on the conjunctiva and cornea as well as other body tissues with different types of *irritants*, **Ricker** and **Regendanz** found that slight degrees of irritation caused dilatation of the vessels and acceleration of the circulation thru the dilators; the constrictors are not affected. Moderate irritation causes narrowing of the arteries and capillaries, and slowing of capillary and venous circulation by stimulation of constrictors. More severe irritation close the smaller arteries and capillaries and cause stasis of venous circulation. The more severe the irritation, the more lasting and extensive are the effects.

Santa Cecilia reports the case of a man, aged 96, negative history, three days after fracture of neck of femur, suddenly became blind in both eyes, supraorbital headache, without any associated paralysis. At examination vision had improved, large objects observed. Pupils normal. Fundi appeared of a homogeneous reddish color, in which no retinal vessel could be distinguished. Condition of retina could not be ascertained. During two days vision greatly improved, but in 11 days no light perception in either eye. Again improvement occurred, recovering his previous vision before death in the following month. Author's diagnosis at first was embolism of central artery of retina, but later regarded it as a case of *vascular spasm.*

PELVIC DISORDERS.—**Gough** is convinced from his own experience, that chronic inflammatory conditions in the pelvis are responsible for a number of eye disturbances, and reports several cases in point. A woman, 60 years, typical case of glaucoma relieved after hysterectomy. Two young women with ocular symptoms so severe as to interfere with their work; symptoms disappeared after treatment for imperforate hymen. Other cases of chorea of eyelids, nervous ocular symptoms relieved by circumcision and after dilatation of urethral stricture.

LEUCORRHEA.—**Dor** calls attention to *iridocyclitis* due to leucorrhea in young girls. Iritis may be puerperal, catamenial, or blennorrhagic, but it is never due to metritis. He cites three cases of blindness due to bilateral iridocyclitis, with hypertonia of the eyeball. History in each case pointed only to leucorrhea of long duration, indicating a chronic and persistent infection. Other causes were entirely eliminated by laboratory methods. The author believes leucorrhea, especially in young girls, is often the cause of iridochoroiditis, and cites his reasons for this conclusion.

GASTROINTESTINAL.—Physiologically, **Roemheld** notes the increased stomach secretion at the sight of food. Pathologically, there are the yellow discoloration of the sclera in gastroduodenal catarrh, hemorrhages caused by vomiting, lesions following hematemesis, keratomalacia and hemeralopia, autointoxications, and botulism. **Wilson**, in a paper entitled *autointoxication* in ophthalmology, points out that endogenous toxins are active over a long period of time; that superficial diseases of the eye are in many cases but the expression of local resistance to microbes and toxins; that autointoxication produces degenerative processes in the lens and loss of power of the ciliary muscle; and that there is a relationship between parathyroid deficiency and lamellar cataract, and between the thyroid and toxemia. In conclusion, he suggests that toxemias play a larger part in the onset of some forms of ophthalmia than is generally believed. **Banister**, in discussing *temporary amblyopias,* states that they are not due to ocular conditions but to momentary circulatory changes in the optical center of the cerebral cortex of one side, or possibly in the center of the two sides. Symptoms if present are headache, scintillating scotoma. The etiology described will suggest the treatment in these cases due to autointoxication.

The literature dealing with the subject of *vitamins* and avitaminoses is reviewed by **Stepp**. The nature of vitamins is not known, but it is known that their absence results in more or less characteristic lesions and eventually death. Some are soluble in water, some in fats. Absence of the former gives rise to beriberi, scurvy, and in young children to the Moller-Barlow disease; of the latter gives rise to rickets, and in ophthalmology to *keratomalacia. Hemeralopia* frequently accompanied scurvy during the war, and was promptly cured by the employment of proper food, that is food containing the proper vitamins. Another form of hemeralopia seen during the war accompanied the socalled "edema disease." It was found that the visual field defects frequently took the form of a blue-yellow blindness, and was to be explained on the basis of an edema of the retina.

Another symptom associated with absence of vitamins is the hemorrhages of the various parts of the eye found in *scurvy*. In children especially, there may be an extensive hemorrhage into the orbit with exophthalmus. The most important conditions due to lack of vitamins are keratomalacia and xerophthalmia. Experiments on rats show, that in about 3 weeks after feeding with avitaminous foods, there appeared alopecia of the lid and enophthalmus; 2-3 weeks later the cornea appeared dry, became cloudy and finally ulcerated without symptoms of inflammation. Keratomalacia is very prevalent in many countries, for example Brazil, Japan and Denmark. The latter country produces a large amount of butter, but it is exported, the children being fed on the fat free residue.

METABOLISM.—In a study of ocular findings in cases of abnormal basal metabolic rates, **Stegman** finds in 585 fundus examinations, 78 cases (aged from 12 to 64) to be contained in the list of abnormal basal metabolic rates. Every case but two with lens vacuoles proved to have an abnormal metabolism. Lesions of basic importance were the first fine specks or vacuoles in the lens, the first pigmented area near the fovea or the first vitreous opacities. He mentions also endocrin stigmata of the skin and its appendages, general structural abnormalities, color of the sclera, symptoms of easy fatigability, headaches, vasomotor and neurologic disturbances, and in secondary sex changes.

FOCAL INFECTION.—Focal infection in relation to diseases of the eye is the title of a paper by **Billings.** He discusses the site of primary focus of infection, the etiology, the susceptibility to focal or metastatic systemic infection, the diagnosis, the mode of dissemination of infectious microorganism from the focus of infection—hematogenous, lymphogenous, systemic intoxication, foci and anaphylaxis—and finally, metastatic or systemic or focal infection as acute or chronic expressions of disease.

Brun writes a paper on diseased *teeth* as possible foci of systemic infection. Value of correlated findings in diagnosis is discussed, also the avenues of attack in periapical diseases; the "dead tooth" is defined; and the ophthalmic reactions in oral sepsis are considered. Eight cases are reported in some detail illustrative of possible foci of ocular infection. **St. Martin** reports the case of a woman, aged 27 years, who had rapidly lost vision of the left eye over a period of ten days. The fundus was normal, but a large central scotoma was present, and there was postbulbar sensitiveness on pressure. Two left premolars with infected roots were removed, and immediate improvement followed, normal vision being restored at the end of two weeks. He refers to similar cases reported in which a dental origin had been traced.

Three cases of papillitis believed to be due to *tonsillitis* are reported by **Harry.** Tonsillar enucleation and the administration of sodium salicylat effected a cure in each case. A case of intermittent *ophthalmomalacia* is reported by **Fields.** A colored woman, aged 30, bilateral enlargements of thyroid; 25 mm. exophthalmos; no eye lesions of importance, tension of right eye normal, that of left eye minus 2, the latter exhibiting easy wrinkling and indenting of cornea with a probe; physically normal; palpitation, slight tremor of hands; enlarged and infected tonsils. After tonsillectomy, symptoms subsided and thyroid diminished markedly in size. The author believes this a case of intermittent ophthalmomalacia due to a thyrotoxic patient, in turn due to the infected tonsils which produced a perverted condition of the gland.

The character of *iritis* caused by focal infection is the title of a paper by **Benedict,** in which he reviews the experimental researches on this subject since 1913 made by Rosenow, Lang. Brown and Irons, Lewis, Levy, Steinbugle and Pease, and discusses at length the correlated data which these observers have brought forth. Iritis was produced in rabbits when injected with a culture taken from a person having acute iritis, but was not produced when inoculated with organisms taken from persons whose eyes were not acutely inflamed.

That iritis was produced in animals by bacteria carried to the eye by the blood stream was amply demonstrated. A culture made from the iris of a rabbit was injected into the anterior chamber of the right eye of another rabbit; on the following day the same organisms, green producing streptococci, were recovered from the uninoculated left eye. Organisms obtained in cultures from dental abscesses and granulomas were green producing streptococci (short chain) and diplococci (viridans). Streptococcus viridans appeared to be the organisms that produced the lesions in rabbits, the staphylococcus seemed to be a harmless organism in this respect.

Organisms grown on plates seem to lose their peculiar infecting power for certain tissues (muscles, etc.), whereas, when grown in tall tubes of medium retain this power. This sustains Rosenow's contention, that in order to retain a specific affinity, the organisms must be grown under conditions of oxygen tension similar to those to which they are accustomed. The tall tube development allows the accustomed oxygen tension necessary, for the organisms usually develop near the bottom of the tube and gradually come to the top as they acquire the ability to grow in the presence of more oxygen.

The author concludes, that iritis caused by bacterial infection seems to be an inflammation of muscle tissue at the place corresponding to the parts of muscles affected in rheumatic affections of the limbs and trunk. That iritis of focal infection origin is a myositis, caused by an organism that at some period of its growth may cause iritis, and at other periods inflammation of some other muscle. That this affinity for iris tissue becomes a function of the organism spontaneously, or acquired by growth on iris tissue. That the affinity for the iris is easily lost by the organism when grown in different environments, and that it will change its affinity for special structural tissue or even lose its virulence to a marked degree. As bacteria around the teeth and tonsils are constantly undergoing changes of environment, they suffer a change of function and a change of virulency.

Schmelzing directs attention to disease of the anterior uveal tract in *furunculosis* and acne vulgaris and reports three cases. One, a man, aged 20 years, had a furuncle above right eyebrow followed in a few days by involvement of the eyelids, severe iris engorgement, ciliary injection, contracted pupils and sluggish pupil reflexes. The furuncle and iritis showed parallel improvement and recovery. Second case, man, aged 25 years, had a furuncle of cheek accompanied by iritis on the same side, both running a parallel course, improvement and recovery. A third patient had an iridocyclitis in the course of acne vulgaris. apparently due to an acne pustule. He believes that many cases of socalled rheumatic iritis are metastases from various infectious diseases.

Junius calls attention to a rare rheumatoid affection with simultaneous disease of the eye, in which there occurs a rapidly advancing stiffening of the joints and of the vertebral column, together with a chronic iridocyclitis. He refers to one case in which there was a nodular *iritis* of the tuberculous type, but without any traceable signs of tuberculosis. The question of focal infection is not referred to.

NASAL AND ACCESSORY SINUS DISEASE.—**Loeb** and **Wiener** in a paper entitled the borderland of otolaryngology and ophthalmology, emphasize the recognition and study of related ocular and nasal sinus diseases. The anatomic relationship is dwelt upon in detail. Phlyctenular conjunctivitis related to adenoids; tonsillar infection to iritis and iridocyclitis; keratoconjunctivitis to intranasal disturbance (Magitot's report is referred to); purulent affections of the sinuses definitely related to ocular complications are classified into four groups—ethmoid, sphenoid, frontal and maxillary. Clinical symptoms as related to involvement of each portion of the eye are considered in detail, and a series of illustrations show the anatomic conditions following extension of disease from the sinuses to the eyes.

Van der Hoeve writes a paper on optic nerve and accessory sinuses, and discusses, (a) the diagnosis of the optic nerve disease, (b) diagnosis of the sinus affection; (c) the relations between those diseases; (d) the treatment. See p. 374.

Under the first heading, he concludes that "the ophthalmologist has in the eye no sign at all to distinguish the origin of a retrobulbar neuritis." As to the diagnosis of sinus disease, he concludes that "the rhinologist can not say with absolute certainty that a person has no sinus affection". He points out the anatomic and histologic relations between optic nerve and sinus disease, referring especially to the three histologic examinations on record, two tumors of the sphenoid (Birch-Hirschfeld, De Kleipn and Gerlach) and one of pansinuitis (DeKleijn and Gerlach).

He outlines three ways in which an optic nerve can be affected by sinus disease, and distinguishes between reparable and irreparable optic nerve changes. Opening of the sinus, even if nothing pathologic is found in the sinus, may be of passing or permanent benefit on the optic nerve disease.

He concludes by referring to the relations between ophthalmologist and rhinologist in the course of study and diagnosis of these cases, and emphasizes what the attitude of each should be toward each other in the cooperative management of the particular case. He pleads for a more uniform nomenclature, for more statistics of the advantages which the eye derives from a sinus operation and of the damage which is done to the nose, and finally for more statistics to solve the question, "should we operate on the nasal sinuses in optic nerve disease of unknown origin?"

Rhinogenous origin of *retrobulbar neuritis* is discussed by **Hajek** in a paper, showing that pathologic processes in the optic nerve are often caused by ethmoidal and spenoidal inflammation. These can not be differentiated clinically, because myosarcoma (Polyak in 1904) of the sinus may injure the optic nerve thru proliferation thru the sphenoid. Inflammatory exudates or polypi of the accessory sinuses may affect the nerve thru pressure, and he refers to a case of his own of mucocele of the sphenoid, in which the optic nerve recovered rapidly after evacuation of the mucocele. He further cites several case histories to prove that improvement and fluctuations of the vision occur when no nasal treatment had been undertaken.

A case of *mucocele* of the spenoidal sinus and posterior ethmoidal cells with atrophy of the optic nerve is reported by **Van der Hoeve.** At operation it was found that the roof of the spenoidal sinus had been destroyed. the probe passing thru to the dura. X-ray did not determine whether the sinuses on the other side were free or not. Etiology was uncertain. He gave a list of the eight cases, reported in the literature. Author emphasizes that in cases of exophthalmos and disease of the optic nerve of doubtful etiology, the accessory sinuses should be opened, that the diagnosis may be made more certain and proper treatment administered. This is true not only of mucocele but also for empyema. H. Snellen, Jr., advocated this 25 years ago.

In a paper concerning some rhinologic experiences in ophthalmology, **Sluder** calls attention to other eye disorders, besides optic neuritis, that may be relieved by the rhinologist. *Choroiditis* with or without hemorrhage, with paranasal cell disease as a causative factor, has been more frequent than any other eye lesion. Other ocular lesions mentioned are certain corneal and iris inflammations. Also dilatation of the pupil, paralysis of accommodation, photophobia, blepharospasm, scotoma scintillans, ophthalmic migraine, and sudden blindness are mentioned as recognizable among the infrequent conditions secondary to paranasal cell disease.

Duverger and **de Lamotte** state that it is not sufficient to simply find that there is no visible pus in the nasal cavities, but thoro search must be made for obstruction of the outlets of the cavities. Four cases are reported showing the vacuum sinus syndrome of Sluder, relieve by submucous resection of nasal septum or removal of anterior ends of middle turbinates and enlargement of the nasofrontal ducts. **Stark** writes on retrobulbar neuritis secondary to diseases of the nasal sinuses and reports two cases.

Siegrist reports four cases of disease of the retina and its vessels, in which no cause could be found except an inflammation of the accessory sinuses. Treatment of the sinuses was followed immediately by improvement of the retinal lesions. Author therefore believes that affections of the accessory sinuses may cause disease of the retinal vessels. He also reports the case of a young girl with monolateral choroiditis disseminata, in whom an ethmoiditis, on the same side as the ocular lesion, appeared to be the only cause. Ophthalmic lesions dependent on endonasal affections is the subject of a paper by **Diaz Rodriquez.**

White, in writing on the differential diagnosis and operative technic in accessory sinus blindness, especially emphasizes the signs in subacute and chronic forms of sinus disease. He refers especially to sudden total loss of vision and scotoma as being indicative of the disease in spite of negative intranasal examination and suspicious or negative X-ray findings, other apparent causes being negative. Local, intracranial and general causes are given and a neurologic examination is outlined. Reports from literature and cases are cited.

Mundt discusses headache from the standpoint of ophthalmology and otolaryngology, and differentiates between those due to eyestrain and those from otitic and paranasal sinus disease. **Matson** reports a case of progressive loss of vision of both eyes in a man 21 years old; pupils dilated and sluggish to light; fundus of each eye negative; negative laboratory and X-ray findings. History of drinking "moonshine" liquor.. Question of *wood alcohol poisoning* or sphenoidal-ethmoidal disease. **Layman** reports on traumatic frontal sinus abscess involving the eye. **Tait** washes out the nasal duct and lacrimal sac in all cases of purulent nasal infections. He suggests thoro study of nose and sinuses before operation on eyeball. **Davis** advises the use of stock vaccines in cases of sinus infection. Uses it in 90 percent of his cases. His experience of six years in this method of treatment convinces him of its value.

Griscom reports a case of heterophoria in a man, 30 years old, who was relieved of symptoms of headache and ocular discomfort by removal of a septal spur which caused pressure against the turbinate. After the operation, hyperphoria of 4 prism diopters without variations was present, and the correction of this incorporated in his glasses gave relief from muscular asthenopia. The author believes the predominating etiologic factor was the pressure between the spur and the middle turbinate, which reflexly caused an irritability of certain extraocular muscles.

Galand reports a case of polysinuitis complicated by orbital phlegmon and serous meningitis. Following an attack of grippe, the patient had right sided headache, exophthalmos and swelling of the lids. The nasal mucous membrane was hypertrophic, but there was no sign of sinus affection. Operation showed pus in the orbit, and in the frontal sinus, destruction of the sinus floor, and pus in the ethmoid. Later, headache and Kernig's sign; lumbar puncture showed nothing. Complete recovery.

Ewing reports two cases of nasal furuncle with ocular complications. In one case the infection invaded the lids, orbit and sinuses, death following four days after severe illness began—staphylococcus aureus isolated. In a second case, very similar, lids and orbit involved, exophthalmos and marked chemosis, swelling of disc and retina both eyes; swelling and induration left side of face. Death occurred 10 days after first seen. Neither case improved on any treatment, deep orbital incisions and drainage of sinuses.

MYASTHENIA GRAVIS. Three cases of myasthenia gravis are reported by **Posey.** A man, aged 67, overworked for some time, showed myasthenia with asthenic bulbar symptoms, dysmasesis, dysarthria, dysphagia, ophthalmoplegia, oral sepsis, achylia gastrica, occult blood in feces, a positive Wolff-Junghams test in gastric contents, obesity, atherosclerosis with moderate arterial hypertension, diffuse dilatation of the aorta and slight albuminuria. This case, a severe form of the disease, died from cardiac failure 2 1/2 years after appearance of the disease.

Two other cases of milder form of the disease, one a man of 20 years, the other a boy aged 12. Both patients showed the characteristic facies of moderate *ptosis*, more pronounced in one eye; in both the extraocular muscles were affected. The disease disappeared in each case after persisting for a time, altho one died 13 years later from disease of the coronary arteries.

The origin and nature of the disease is not definitely known, altho 300 cases have been reported during the past 30 years. It is characterized by an abnormal liability of voluntary movements to tire thruout the whole body, muscles supplied by the bulb being particularly affected. It is usally chronic with periods of remissions and exacerbations, the muscular symptoms always aggravated by fatigue and frequently disappear after periods of rest. Ptosis or diplopia may disappear and reappear. Imvolvement of the facial, hypoglossal or accessory nerves are the initial symptoms in about 25 percent of cases.

Overwork and emotional excitement are initial factors, perhaps cooperating with some unknown infection and some endocrin disturbance as shown by unusual enlargement of the thymus. It may occur also as a complication of exophthalmic goitre. It must be differentiated from hysteria, tabes or ptosis myopathica, which is a primary atrophy of the muscle. Absolute, prolonged rest is the best known treatment, perhaps with gentle massage and the use of strychnin.

Coriat, records his personal experience with the observation and study of 18 cases of myasthenia gravis. The symptomatology is discussed in detail, the reactions to faradism and galvanism are outlined, and a paragraph is devoted to treatment.

The author concludes that it is doubtful if the disease is a pure neurosis, in spite of negative anatomic findings in the central nervous system, altho certain neurotic and emotional features can be distinguished. Future investigations must be directed along several lines, such as the vegetative nervous system, which probably regulates muscular metabolism; toxic causes, because certain cases seem to follow infectious disorders; endocrin disturbances; and finally, an examination of the unconscious psychic states.

MULTIPLE SCLEROSIS.—**Holden** presents a paper on the ocular manifestations of multiple sclerosis, in which he discusses especially the optic nerve changes and the fields of vision. After excluding disease of the paranasal sinuses and poisoning by chemicals, diabetes, retinal lesions and hysteria, a diagnosis of multiple sclerosis can be made with reasonable certainty, if the onset is acute and one or more small *scotomata* at or near the point of fixation are present; it is conclusive, if one or more additional symptoms of of the disease can be elicited such as ankle clonus, Babinski's reflex or diminished abdominal reflexes. Optic neuritis and multiple sclerosis is the subject of a paper by **Marburg,** who finds a destruction of the medullary sheaths, the axis cylinders often continuing to exist. Foci occur in various locations, the vessels may be only slightly affected, and atrophy may develop rapidly. Optic nerve affection is characterized by the transient nature of the symptoms; tends to recurrences; seldom develops permanent changes; temporal palor of the disc may remain; scotomata often disappear.

Wernicke presents evidence that pernicious *myopia,* as well as *glaucoma,* may be traced to multiple sclerosis—both intraocular manifestations of the same process. He argues further that all the nervous disturbances observed in diabetes are evident likewise in multiple sclerosis, and that the latter may be capable of inducing glycosuria by way of the nervous system, liver, pancreas, etc. The foci of multiple sclerosis seem to spread by way of the blood. Hence the disease does not necessarily begin in the brain, and foci are liable to develop elsewhere. The probability of becoming involved is greater the larger the organ, but the symptoms therefore depend on the function and on the sensitiveness to pain. There is much to sustain the assumption that such foci may be responsible for chronic muscular and joint rheumatism as he explains; the foci here making their presence felt early by the pain induced in these more sensitive regions. Inability to stand cold is common to both rheumatism and disseminated sclerosis.

HYSTERIA.—**Marin Amat** reports a case of unilateral *amaurosis* occurring in a woman, aged 26. Left eye showed flaccidity of the lids; headache, anesthesias and other symptoms. Cure obtained by suggestion, tonic and sedative treatment, and mild eye lotion. The case illustrates the rôle of ordinary domestic life in causing hysteric manifestation. Symptoms and diagnosis are discussed. Hysteric sensory and secretory affections are more common than hysteric motor disturbances. Total bilateral blindness is rare, but blindness in one eye with perfect vision in the other eye is still more rare.

A case of sudden blindness is reported by **Koobs,** that of a girl, aged 15 years, vision of O.D. = 20/20; O.S. 20/40. Diagnosis of chorioretinitis was made and tonsillectomy and adenoidectomy were performed with apparent temporary relief; but later over night, she suddenly became totally blind in both eyes. All clinical and laboratory tests were negative. Operation for paranasal sinuitis was made without result. But suggestion from day to day improved her vision until she recovered her previous visual acuity, and has had no further visual disturbance. The writer believes that the diagnosis of hysteria might have been made at the beginning had the pupillary light reflex been noted; in fact this was the important differential point in the case, but the previous chorioretinitis was misleading. **Coleman** reports a case of hysteric amblyopia in a girl, aged 12, who was chased and badly frightened by another child wrapped in a sheet. Examination revealed normal eyes in every respect, but she was unable to count fingers at several feet and complained of dread of light. After proper management and arduous household duties, she rapidly became normal.

EPILEPSY.—**Wilson** writes a paper on psychologic peculiarities in certain visual auras in epilepsy and relates cases of idopathic epilepsy, distinguished by a mental state, presenting curious psychologic characteristics of its own. He refers to Dr. Hughlings Jackson, who has directed attention to this condition, and used several terms to describe the occurrences, one of which was a "voluminous mental state". The author states that there are two distinct types which would interest the ophthalmologist. First, the "de javu", or the familiarity type and its converse the "strangeness" type (in which surroundings and conditions either seem very familiar or unaccountably strange); the second, is the "visual memory" type. Examples of both are given from his own experience.

Leri and **Behague** state that especially since the war they have observed a number of cases of occipital lesions in which convulsive attacks developed preceded by visual symptoms (aura), or in which there were recurrent visual disturbances of the nature of epileptic equivalents. They report three cases of the former type and ten cases of the latter type. The visual symptoms vary from visual hallucinations to scintillating scotoma, hemianopsia, and temporary obscuring of the entire visual field. The authors report four other cases in which the trauma did not affect the occipital lobe directly, but indirectly, causing similar visual disturbances. Such visual symptoms associated with epileptic attacks or occurring as epileptic equivalents following brain trauma or disease, are in the author's opinion, an absolute indication of the involvement of the occipital lobe.

PARALYSIS AGITANS.—In a paper entitled disorders of the ocular apparatus in Parkinson's disease, **Duverger** and **Barre** call attention to a previous report in 1910 of the recognition of *diplopia* occurring in paralysis agitans. Now five cases are reported, 2 classical cases of Parkinson's disease and 3 of pseudoparalysis agitans postencephalitica. The sensorial apparatus remains intact; no retinal or optic nerve lesions; but the motor apparatus is almost always attacked. Incomplete ptosis is very frequent. Disorder of ocular movements is essentially that of abolition or insufficiency of convergence. The patient rarely complains of diplopia, but it can be brought out by a red glass. The syndrome en resumè is: Incomplete uni- or bilateral ptosis; trembling of the orbicularis; insufficiency of convergence with crossed diplopia for near; pupillary syndrome inverse to that of Argyll Robertson. The coexistence of pathologic ocular and vestibular phenomena establishes a relationship indicating a lesion of the posterior longitudinal bundle as the sole or principal cause.

INTRACRANIAL HYPERTENSION.—**Black** states that ocular changes attendant upon injuries to the head and brain are important factors, when studied in connection with general symptoms, in estimating the extent of injury, aiding in localization and determining the treatment. Extraocular expression of these injuries are muscular paresis, paralysis and conjugate deviations. The intraocular are choked disc, optic neuritis and retinal hemorrhages.

Nystagmus may result from injury to the occipital region, but has been observed in injuries of the frontoparietal region. Disturbances of motility are infrequent complications. Value of pupillary reaction has been greatly overrated; usually early miosis, followed by mydriasis. Choked disc, when found with other symptoms of increased tension, indicates imperative operation. Choked disc without other symptoms is not sufficient for operation, unless the intraocular manifestations are progressive in character; absence of choked disc should not preclude operation when other symptoms indicate its necessity.

Natale writes on cranial hypertension in ophthalmology; and **Mellor** discusses eye symptoms and disease in relation to organic disease of the brain and spinal cord.

Concerning the association of neuroretinitis in each eye, with unilateral external ophthalmoloplegia, **Ring** reports a case of a colored girl, 13 years, with symptoms of vomiting, convulsions, staggering gait, pain in right arm, temperature. Ocular picture of a right-sided, almost complete ophthalmoplegia externa, with hugh neuroretinitis upon the same side, and much lower grade neuroretinitis of opposite eye. Ocular picture, in writer's opinion, due to intracranial growth, disease of the sinuses, which was definitely demonstrated, in this instance being secondary. Subsequent study impossible, as was pathologic confirmation after death. The eye and the nervous system is the subject of a paper by **Levinsohn. House** presents the neuropsychiatric views of disorders of the eye.

The ocular affects of brain tumor and other conditions increasing intracranial pressure are discussed by **Jorge** with cases illustrating them. The first patient, a woman of 29, had protrusion of the right eye with exposure and opacity of the cornea; and in the left eye optic neuritis. Decompressive trephining was done and a diffuse glioma of the temporal lobe revealed. Five months afterward the patient remained improved with vision of 2/3. A girl of 11, in whom cerebral tumor was diagnosed, showed edema of the pupilla and choking of the vessels. Decompressive craniectomy of the parietal region was followed with improvement in general condition of vision which rose to R. 1/2; L. 1.

TRIGEMINUS NERVE. — Transorbital puncture of the Gasserian ganglion is the subject of a paper by **Van Allen.** Injection of the trigeminus dates from 1840, and the development stages are 3 in number. These are outlined in detail. Author's method of approach is via the orbit, pathway along the median wall, and the portal of entrance the sphenoidal fissure, needle guided by sense of touch along smooth surface until its progress is obstructed by bony fossa lodging the ganglion. Dangers are rupture of median wall of orbit, puncture of cavernous sinus, with thrombosis but never hemorrhage, and puncture of silent area of brain which is without ill effects. Of 50 punctures on 25 cadavers, 41 were successful. Clinically in 5 cases, there was an 80 per cent success, no damage done by needle, no pain passing thru orbit, but very painful behind it. His descriptions and case reports are in detail. Trigeminal neuralgia is discussed by **Salva.**

HERPES ZOSTER.—**Rossi** writes a discourse on herpes zoster associated with Bernard-Horner syndrome; and **Merida Nicolich** reports on the unilateral syndrome of Claude Bernard-Horner after extirpation of lymphoma of the neck. **Thomas** reports a case of ophthalmic herpes zoster, in a man of 55 years, at first mistaken for erysipelas. Very bad teeth which he refused to have attended, were the only apparent etiologic factor. Eruption cleared, pain remained, large scar of upper lid was permanent, tho cornea escaped. Herpes zoster with supraorbital and thoracic eruption with case report is discussed by **Corson** and **Knowles.**

OCULOCARDIAC REFLEX.—**Milani** presents a paper on the reflex phenomena following ocular compression. Modification of cardiac or respiratory rhythm, and of vasomotor equilibrium is well known. The technic varies with the originator. Not only the intensity of pressure but the duration of pressure has an important bearing on the results. The subject may be lying down, calm and quiet; or may be in the standing position, when the phenomena are more evident. The reflex may be inverted, abolished and variable according to the degree of reaction elicited, the technic employed and the observer making the experiment. Common causes of variation are emotion, pain, fatigue, irregularity of pressure and repetition of the test. He believes the ocular compressor of Roubinowitch is the most accurate and reliable apparatus.

Unilateral pressure is said to produce great stimulation of the right pneumogastric. There is evidence to show that the cardiac reflex is accompanied by a vasomotor reflex. The author also refers to the respiratory reaction to ocular compression, and presents evidences of definite sympathetic nerve reactions following traumatism or section of various nerves, cervical medulla, etc.

Espiño recalls the extensive literature on this subject, which contains so much that is contradictory, that it is difficult to estimate the significance of this reflex. He tested 35 inmates of an institution for the *insane,* each tested three times. The response to compression of the eyeball was a moderate slowing of the pulse and respiration. The reaction was never intense and at times no reaction was present, or the pulse and respiration was speeded up instead of slowed. Response varied at different times in the same individual, even in the course of the same day. It seems evident, the author continues, that this and similar sensory stimuli are able to induce a general motor reflex in the vegetative system which enables us to penetrate farther into the "No Man's Land" of psychoses, neuroses, etc.

Licci writes a paper on the oculocardiac reflex and the exploration of cardiac function from a clinical study of 400 observations. He concludes, (1) The oculocardiac reflex is a means of studying the cardiac function. (2) It is a method, rapid, safe, easy and constant. (3) It is of great diagnostic importance. (4) It is possibly of notable prognostic value, because its findings precede other symptoms. (5) It may be employed in certain contingences as a therapeutic substitute.

Barre and **Crusem** abbreviate oculocardiac reflex to "roc." They report extensive research with it in normal persons with a spring eyeball compressor, with which the pressure can be graduated and recorded. Pulse may be slowed by it up to 30 or 40 beats in apparently normal conditions. They attach no importance from the diagnostic point of view to the inversion of the "roc." They explain the oculocardiac reflex as a sympathetic vagus phenomenon, the trigeminal not involved. **Alchieri** presents the present status of the oculocardiac reflex in medicine; **Trias** reports on observations made in pediatrics, and **Alzina** describes the reflex in healthy children.

Jenny studied the heart action graphically in 120 children and adolescents during pressure on the eyeball or supraorbital nerve; in 85 cases the string galvanometor was used. In all cases an action of the vagus on the heart rate was evident, sometimes to the point of stopping the heart for eight seconds; in 17 cases the conductivity of the heart muscle was altered. In addition to auricular extra systoles, and in one case ventricular extra systoles, automatic beats were frequent. The origin of these as in the auriculoventricular node, its coronary fibers and the crus commune of the bundle of His. In 23 cases the pressure wave was reduced or disappeared entirely, owing to changes in the position and the filling of the heart during pressure on the eyeball.

OCULOESOPHAGEAL REFLEX.—**Pirazzoli** studies a small series of radioscopic observations on patients suffering from various affections of the digestive apparatus, in whom he repeatedly noted (during ocular compression) a prolonged arrest of the opaque mass above the cardiac orifice of the stomach, who presented instead a normal permeability of the oesophagus, which also appeared considerably enlarged. He also observed the modifications of the pulse thru the oculocardiac reflex which accompanies in the majority of cases the oculoesophageal reflex. In other cases the oculoesophageal phenomenon was alone demonstrable, appearing with great rapidity and distinctness. Author concludes by asserting the existence of an oculoesophageal reflex which determines the dilatation of the esophageal canal and rapid evacuation of the esophagus. The reflex is probably determined reflexly thru the trigeminus and medulla, or rather by a relation of the trigeminus with a center in the corpora quadrigemina. Further investigation may prove the reflex to be of diagnostic value.

Munier reports epileptiform attack caused by testing oculocardiac reflex.

CERVICAL SYMPATHETIC. — **Throckmorton** reports 3 cases of lesions of the cervical sympathetic: 1st, Paralysis due to malignancy complicated by pseudoptosis and inequality of the *pupils;* 2nd, paralysis due to toxemia of pregnancy; 2 days following Caesarian section, contraction of right pupil observed and well marked pseudoptosis; 3rd, irritation due to enlarged thymus. Pupil dilated and convergent squint, which was due to improper muscle balance and bore no relation to symptoms produced by the thymus enlargement (improved by X-ray treatment).

EXOPHTHALMIC GOITRE.—**Parker** reports a case of double *luxation of eyeballs* in a case of exophthalmic goitre. Male, 60 years, bulging of the eyes for several months previously, nervousness and blindness both eyes; symptoms of hyperthyroidism; Wassermann 1+. Both eyes luxated, lids partially closed back of equator of globes; chemotic conjunctiva; entire cornea of each eye was infiltrated and edematous; a large central ulcer present in each cornea. After hospital treatment of silver locally and high caloric diet for two and one-half months, the lids could be closed over the globes, patient gained 25 lbs. History of these cases is reviewed, and two photographs in illustration are presented.

SKIN DISEASE.—**Friede** reports in detail the clinical history of a man, aged 48, *in whom hydroa vacciniforme* of the the parts of the skin exposed to the light of the sun during the summer months commenced in early childhood, affecting hands, face, especially the nose and ears. Not until his 35th year did the eyes become involved in intimate connection with the skin disease. The primary direct lesions of the eyes were papulous efflorescences on the lids, infiltrations and ulcers of the cornea and necrosis of the sclera. Suddenly, under intense photophobia and lacrimation, a severe diffuse inflammation of the ocular conjunctiva set in with ciliary injection and succulent chemosis. Soon flat ill defined congested subconjunctival nodules arose on places exposed to the sunlight. These assumed a bluish-red and finally a yellowish discoloration, indicating necrosis of the sclera. The thinned conjunctiva perforated, so that the necrotic masses were laid bare. After gradual sloughing, deeply punched out holes of the sclera were formed, their base covered with thin cicatricial tissue so that a slate grey, not bulging spot of the sclera remained. On the left eye a flat *staphyloma* developed in the temporal portion within the palpebral fissure. The cornea showed maculae, and there were remnants of a former iritis.

Secondary changes were: *exophthalmus* from orbital cellulitis, caused by the scleral necrosis and the subsequent inflammatory infiltration in and around Tenon's capsule, atrophy of the optic nerve from the same cause, and symptoms of cicatricial shrinking of the lids. During the regressive period there was intense hematoporphyrinuria. This was of interest, as hydroa vacciniforme is caused by light in consequence of photodynamic sensibilization thru hematoporphyrin.

For prophylaxis, patients suffering from hydroa vacciniforme of the skin ought to wear well fitting coquilles, especially in spring, as then the sunlight is especially rich in ultraviolet rays. For the lids curcuma tinctur, unguent, casein with bolus, ichthyol, zeozon are recommended. An eye affection is most successfully treated by complete exclusion of light.

In presenting the ocular involvement in *xeroderma pigmentosum*, **Wolf** reports a case of a girl, aged 6 years, with no history of a similar disease in her family, whose face, at the age of 2 or 3 years became badly freckeled; 1 1/2 years afterwards the eyes became involved.

Details of the skin involvement are outlined. The eyelids were likewise affected; tissues of lower lid atrophic, slight ectropion, complete absence of cilia; external canthi obliterated; conjunctiva injected, and in lower lid very thin, shrunken and scarred; lower conjunctival sac very shallow. The right eye presented a coarse patch of tissue similar to an epibulbar tumor proliferating over cornea and involving about 2/3 the diameter of the cornea; the tissue was uneven and hard and with apparent walled off margins; iris discolored, otherwise normal.

The left eye was similarly involved; thruout the lower conjunctiva and cornea was an irregular dark brown pigmented patch of tissue with uneven surface, not unlike a pigmented nevus of the conjunctiva; superficial vessels large and extending over the cornea; some of the lesions involve deep corneal substance.

Intense photophobia, blepharospasm and lacrimation, both eyes. Tumor of right eye was removed and is described in detail, the final pathologic diagnosis resting between carcinoma and chronic hyperplasia.

Ascher and **Klauber** call attention to the possible connection between affections of the conjunctiva and cornea (of eczematous conjunctivitis type with some peculiarities) and *foot and mouth disease,* illustrated by the clinical histories of three children who apparently had been affected thru the milk of cows so affected. The peculiarities were strikingly slight photophobia in proportion to very extended corneal infiltrations, which were very sharply defined, with minimal conjunctival injection. In spite of the deep infiltration, only superficial vessels in the cornea. Even after relapses, very slight tendency to disintegration, but slow absorption and formation of dense scars of very sharp outline.

Procksch reports a case of bilateral *keratitis* and *iridocylitis* in multiform *exudative erythema. Conjunctivitis* is a frequent complication of the disease, but the author could find no case reported in literature in which bilateral keratitis and iridocyclitis occurred. In the author's case, a bilateral catarrhal conjunctivitis presenting during the course of a typical exudative erythema was followed 2 weeks afterwards by a bilateral keratitis causing pain, photophobia and lacrimation. Appearance of the cornea was peculiar, small round interstitial infiltrations arranged in concentric circles. Five days later a bilateral fibrinous superficial iritis developed, with precipitates and synechia of the pigmentary layer, exudate on anterior capsule of lens, and hyperemia of retina. Within 5 weeks, treatment being hot applications and atropin, only a slight infiltration of cornea and no precipitates. Complete recovery and normal vision.

LEISHMANIOSIS.—**Carvalho** reports a case of ocular leishmaniosis occurring in a man, aged 32, a laborer. Mouth and pharynx showed ulceration extending on both sides of the pillars with characteristic granulation; partial destruction of the left pillar and the corresponding part of the uvula; inflammation of the mucous membrane intense, and more or less adherent fibrinopurulent exudate. Left eye showed an irregular circular spot in the cornea, occupying the external quadrant. Conjunctival secretion abundant, marked photophobia. The symptoms were so characteristic that a diagnosis of leishmaniosis with ocular lesions was made without laboratory examination.

OSTEOMYELITIS.—**Marx,** in a paper on the eye symptoms due to osteomyelitis of the superior maxilla in infants, refers to the disease as having formerly been known as acute *sinuitis* of the antrum of Highmore, and emphasizes the importance of a correct diagnosis.

He reports three cases: One three weeks old, in which there was a conjunctivitis, a fistula in region of right lacrimal sac and nasal discharge. Cured by operation. The second case had swollen and inflamed lids, chemosis, discharge from mouth, both maxillae and a fistula discharging pus thru both lower eyelids. Apparent cure followed treatment. The third case presented swollen lids, chemotic conjunctiva with purulent discharge, a fistula in the upper lip, swollen palate and alveolar process; also there was pronounced protrusion of right eye; ocular movements in this eye were reduced, veins of the fundus swollen. The staphylococcus was isolated in all the cases. A cure was finally affected.

He cites 35 cases known to literature, and tabulates these cases with special reference to the ocular symptoms, and further sketches the etiology, symptomatology and the progress of the disease (referring to the monographs of Brown Kelly and Francois). As regards the origin of the infection and the point at which the bacilli enter the maxilla, neither the accounts collected in the literature nor his own experience has determined with any degree of certainty these points. Of the 35 cases tabulated, 30 developed eye symptoms, and it is not certain that the remaining 5 did not have them, records of some of the cases being too incomplete to determine. *Exophthalmos* was found in 10 of the cases. The death rate is 25%.

ANESTHESIA OF JAW.—**Schubert** relates a case of sudden spasmodic closure of the lids following an injection of 1 cc. of 2% novocain-adrenalin solution into the infraorbital foramen, for a radical operation on the antrum. The lids could not be opened either by the patient or the doctor. The condition lasted five minutes, and then disappeared without any bad result. A transfer of irritation from the V to the VII nerve is given as explanation of the phenomenon. The author reviews the cases reported in the literature.

GENERAL PAPERS.—A compendium on the eyeground in general disease is published by **Koellner.** He not only emphasizes the interpretation and differential diagnosis of the ophthalmoscopic pictures, but especially deals with their value in the diagnosis and prognosis of general affections. Typical ophthalmic changes in different general diseases are presented with colored pictures from his own experience. Chapters on arteriosclerosis, optic neuritis, papillitis, intracranial pressure and tuberculosis are written in detail.

Kirk writes on sight efficiency in the general population, presenting a contribution based on the examination of over 30,000 recruits. These cases are divided into four groups; 93.7% being fit for grade 1; 4.2% for grade 2; 1.6% for grade 3; 0.5% grade 4, entirely unfit for any army service. His findings point out that the sight efficiency of a nation is intimately connected with and parallel with its general standard of sanitation and hygiene, and the healthy upbringing of its children.

To emphasize the necessity for cooperation between general practitioner and eye specialist, **Sutherland** writes an outline of some eye conditions in connection with general diseases. Tabes dorsalis is referred to, and he points to the less frequent blindness in smallpox since vaccination was introduced, when 35% of all cases of blindness were caused by the ocular manifestations of this disease. Ethyl alcohol and methyl alcohol are mentioned in this connection. Basedow's disease, arteriosclerosis, focal infections, (teeth, tonsils and sinuses), nephritis and diabetes are the principle subjects of discussion. **Brehmer** discusses headache from the standpoint of the oculist. **Finlay** presents the relation between ophthalmologic knowledge and general medical practice; and **Heine** reviews diseases of the eye in relation to internal medicine and pediatrics. The relation of eye, ear, nose and throat to general medicine is the title of a paper by **Morton. Davis** writes on the pneumococcus in eye, ear, nose and throat.

Visual Hygiene and Prophylaxis

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AND

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A review of the literature from January, 1922, to July, 1922.

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DIGEST OF THE LITERATURE.

Daylight Illumination.—**Harrison, P. J.**, states that tests were made in one factory in which the windows had not been cleaned for several months, demonstrating that fully 50 per cent of daylight was excluded. Not only is the cost of artificial illumination greater when windows are dust coated, but the dirt and semidarkness have a bad psychologic effect on the workers.

Jacobs states that few factories can, under normal conditions, get all the daylight that they require. One textile mill adopted a system of lighting which consisted in merely substituting for the ordinary window glass panes made of glass with prismatic surfaces. Such prisms properly placed will collect the light from all angles and refract it into the shop. Where there are a number of floors requiring the same intensity and direction of light, the strength and placing of the prisms must be varied to meet conditions on each floor.

In deep light wells or courts where there is no direct sunlight, glass canopies are used in addition to the prism glass. They are placed over windows and can be set at a particular angle to the walls so that the light rays are drawn from the sky, received and controlled by the prism, and thrown directly into the interior of the building. Since these prism windows have been installed, this concern has been able to nearly halve its light bills, to say nothing of bettering working conditions both of safety and increased production.

Industrial Lighting.—**Hickerson** states that adequate industrial illumination: 1. Increases production for the same labor cost, or decreases the unit cost of production. 2. Increases the accuracy of workmanship. 3. Lessens the number of accidents. 4. Lessens eyestrain. 5. Betters the morale of workers.

"The workman has greater confidence in himself when his working conditions include ample light. He feels good and on one's physical condition depends to a great extent the quality and quantity of his work. He can see what he is about. He can distinguish acid from oil, can step over beams and castings on the factory floor, can see projecting bars and rods across his path. Because he can see well his feeling of security is greater, his selfconfidence is increased. And on these factors depend a worker's efficiency to a very great extent."

Illumination is not adequate unless it fulfills the following requirements: 1. Illumination must be sufficient. 2. Lights must be so placed that they do not cause the pupils to change size. 3. Light must be steady. 4. Polished surfaces that will reflect light into the worker's eyes must be eliminated. 5. Light must not shine in eyes of other workers.

Kinsman states that the cost of lighting for one firm was cut 60 per cent by the installation of mirrored reflectors. Cutting down on lighting is wasteful economically, as the workman's time is more expensive than the cost of increased lighting.

Lighting codes need to consider, along with the nature of lighting, the reactions of the worker. **Harrington** states, that with a properly designed and installed lighting system there will result, as contrasted with the conditions under a poor system, better health conditions, less labor turnover, greater activities, better workmanship, fewer accidents and decreased spoilage. All of these factors combined assist toward the desired end—increased production.

Hibben, in discussing how seventeen everyday lighting problems have been solved, says, "No lighting engineer can foresee all the peculiar lighting requirements of any industrial plant." The Industrial Manager may find among the examples mentioned in this paper an application which will fit his conditions.

In one factory, where incandescent burners could not be used because of the risk of mantles breaking, owing to the constant vibration, inverted gas burners, each of 75 candle power, with antivibrating springs and suitable shades, were fitted over the benches for local lighting, and a series of lamps of 400 candle power each were distributed down the center of the work rooms for general illumination. **Vorch.**

The British Journal of Ophthalmology says of illumination in factories and workshops:

(a) "Every source of light exceeding 5 candles per sq. in. within a distance of 100 ft. from any workman shall be so shaded that no part of the filament, mantle or flame is distinguishable, unless it be so placed that a line from it to the plane of the eye forms an angle of not less than 20° to the source of light.

(b) "Adequate means shall be used to prevent reflection from a polished surface, and to prevent the casting of shadows which interfere with the work and safety of other workers.

(c) "No light is to be used which flickers or undergoes abrupt changes in candle power."

"Of $350,000,000 wasted annually in the factories of the United States, $30,000,000 is directly chargeable to poor illumination." **Doane** finds from statistics from insurance companies, that 15 per cent of all industrial accidents can be traced directly to inadequate or improper illumination.

If any machine seems to be responsible for a large number of accidents, the lighting should be examined. In one machine shop, one drill press was thought to have a "hoodoo" on account of the number of accidents at this particular press. Investigation proved that there were little reflections flashing back and forth in the eyes. As soon as the lighting was changed the accidents ceased.

W. Harrison reports on works having monthly payroll of 20,000, an improved system of lighting which cost an increase of 2.55 per cent produced an increase of total production of 12.2 per cent. The ability to see ragged edges contributed to reduce accidents, and greater neatness rendered the Saturday afternoon cleaning up unnecessary.

Purdy states that 75 per cent of accidents in factories occur after 4:00 p. m., and that there is an increase of from 50 to 100 per cent in the number of accidents during the winter as a result, partially at least, of poor lighting. In addition to direct lighting when possible, and semidirect and indirect lighting and white interiors, he advocates having all obstructing outside surfaces painted white, as well as using prismatic window glass, daylight reflectors and door panels.

The year's development in the science of industrial lighting shows increased production resulting from the installation of modern lighting in factories, this increase being due to lower accident rate, lessened eye fatigue, improved health and morale, lessening of supervision and labor turnover and reduction of unit cost.

COLOR OF PAINT AND ILLUMINATION.—Paint adds materially to the better operation of the industrial plant. White paint extends the lighting area of every light source, and by throwing light upon the machine it makes faster work possible. Of all colors, white reflects the greatest percentage of light striking at any angle and from all sources, the coefficient of reflection being from 67 to 68 per cent; while light tints of blue and green have a coefficient of only 54 to 55 per cent, and dark shades of red and green only 11 to 12 per cent.

The rays from powerful lights falling upon dark walls give much less light than the rays from less strong lights falling upon walls painted in light colors.

A paint company has recently made a series of tests to discover which colors are the best reflecting mediums. Where indirect lighting is used, a well painted white ceiling will give 20 to 30 per cent more illumination intensity than an ordinary white, buff or similar colored ceiling. The percentage of the incident illumination that is reflected by walls of different colors varies from 80 per cent (white, enamel) to 10 per cent (grass green, enamel).

LIGHTING IN MOVING PICTURE STUDIOS.—The British Commission on the Cause and Prevention of Blindness says, in regard to Cinema Studio Lighting, that there is evidence of only transient injury to eyes in a few cases resulting from the extreme power of the lights used, and that such injuries are due to failure to use proper screens.

The eye trouble is due, in the opinion of this committee, to the unimpeded access of ultraviolet rays.

AUTOMOBILE HEADLIGHTS.—The Committee of Ministry of Transport on Lights on Vehicles avers that any headlight which has a range of forward illumination in excess of 60 feet should have:

(a) A minimum range of forward illumination of 150 feet and a maximum of 300 feet.

(b) A minimum width of 30 feet with a maximum height of 4 feet from the ground at 150 feet from the lamp.

(c) The lower edge impinging upon the road at not more than 50 feet from the face of the headlight.

(d) The field free from dark patches and the illumination reasonably uniform or having good gradation.

SHIP ILLUMINATION.—Owing to the bright light of the chart room preventing him from seeing anything after coming out, one navigation officer keeps one eye closed while in the chart room and finds that this overcomes the difficulty.

ILLUMINATION IN MINES.—**Mueller** gives a survey of the types of miners' lamps. Stationary electric installations are also described, and considerable attention is paid to the mechanical devices by which explosions of mine gas are prevented in case the glass globe is broken or opened while the lamp is lighted. Neon filled bulbs are briefly commented upon.

PROTECTIVE GLASSES.—By means of electricity, **Olsho** states that optical glass can be colored a uniform amber tint, regardless of the difference in the thickness of the different portions of the lens; the tint is permanent under ordinary circumstances, the refractive index is unchanged and no idiosyncrasy against untinted glasses is developed. He also shows that the amber glasses produced by electricity are more effective than those tinted amethyst by the sun's rays.

A general review of the relation of light to heat and ultraviolet rays is given by **Bourgeois** in calling attention to "anactine," a new glass for the protection of the eyes particularly from ultraviolet radiations. It intercepts practically all of the ultraviolet and 40 per cent of the heat rays, but transmits 99 per cent of light rays. Bourgeois finds that patients complaining of asthenopia are doing too much work by any improper light, have inaccurate correcting lenses, have eyes oversensitive from disease, or are suffering from impaired general health, such as anemia, neurasthenia or are convalescing from acute disease. He seems to attach considerable importance to the use of a yellow or orange yellow glass. Reproductions of parts of the spectrum of the iron arc light transmitted thru the air, or different forms of glass, accompany the paper.

The Committee on Ultraviolet and Invisible Transmission of Eye Protective Glasses (Section of Ophthalmology, A. M. A.), says that the harm of infrared rays comes from the thermal effect and that glassblower's cataract comes from the heat of the infrared rather than from the ultraviolet rays which cause conjunctivitis. The report further states that of the infrared rays emitted by a furnace heated to 1000° C., 99 per cent are obstructed by gold plated lenses, 95 per cent by sage green or bluish-green and 60-80 per cent by deep black lenses. For protection from the ultraviolet rays, glasses of black, amber, green, greenish yellow and red are efficient in the order named.

Soderberg states that locomotive enginemen need protection from furnace glare, but colored glasses cause confusion of signals, so he recommends smoked glass goggles. **Bloch** discusses the essentials of a glass for eye protection. It should partially absorb the light, be of an appropriate tint and exclude the ultraviolet rays. **Weiss** writes on the determination of the color and transparency of spectacle lenses.

De Hart gives the value of an eye room arranged by a machine tool company. It was four feet square, with blackened walls, and contained a surgical chair and appropriate solutions. It was specially designed for the prompt removal of foreign bodies, and cost not over three hundred dollars for its full equipment. It effected a great reduction in the number of eyes lost and also in the time lost on account of accidents to the eye.

In an essay upon industrial ophthalmology, **Cross** shows the advantages of an ophthalmic consultant, both to the firm and the employes. His statistical figures are compiled from the accident reports of a large shipbuilding plant, hiring about 30,000 employes per annum, in which he serves as consulting ophthalmic surgeon. It is of interest to note that industrial injuries occur most largely among non-English speaking employes.

INJURIES FROM LIGHT.—**Van der Hoeve** observes that, whereas formerly lack of illumination in schools and factories was so greatly emphasized, today the opposite is the case, in that the artificial light sources are so strong as to cause apprehension as to their effect upon the eyes. Regarding the different parts of the spectrum which can cause disease, the infrared rays have been studied the least. Vogt attributes to them glass workers' cataract. The visible rays are generally considered to be the cause of eclipse blindness. The ultraviolet rays are transmitted, altho the cornea and lens are known to absorb such rays in part. A typical instance of the effect of ultraviolet rays upon the eye is snow blindness. The author suggested many years ago that the ciliary body may be damaged by what is equivalent to phosphorescence. The continued radiation might, in the course of years, cause changes in the epithelial cells, resulting in changed secretion and such trifling alterations in the aqueous might be sufficient to cause sufficient malnutrition of the lens leading ultimately to senile cataract. Ultraviolet rays may also be the cause of senile degeneration of the macula. Ordinarily the author does not think protection against such rays is required, but only when the eyes are more than usually exposed, as at the seashore, on the river, or on ice and snow fields.

Greeff summarizes injuries to the eye from light as follows: snow blindness, glass blowers' cataract, cataract from lightning, senile cataract, ophthalmia electrica, solar eclipse scotoma, erythropsia following snow blindness, aviators' scotoma. He concludes that neither experiment nor clinical experience support the view that modern light sources are more injurious to the visual organ than daylight.

The year's development in the science of industrial lighting shows increase production resulting from the in tion of modern lighting in fac increase being due to low rate, lessened eye fatigu health and morale, lessen vision and labor turnove of unit cost.

COLOR OF PAINT A —Paint adds materi operation of the in paint extends the light source, and the machine it sible. Of all greatest perc any angle a efficient o 68 per ce green ha per ce green

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Elliot found cata- lived in the Eng- Schanz was led to make more extensive researches by the observation of Behr, who by testing dark adaptation in aphakia, was able to establish decided decrease in retinal excitability. Schanz attributes this to the increased amount of ultraviolet light which reaches the retina after removal of the lens. He tested the adaptation in workmen with lenses intact, who were exposed for a considerable time to strong light. Of forty-two glass blowers, all showed decided diminution of twilight vision, with the exception of one man who for five years had continuously worn euphos glasses at work. These glass blowers, like patients operated upon for cataract, are unaware of any such disturbance. Schanz found the same anomaly in a banker who constantly worked under electric lights, in two boiler cleaners who constantly worked under similar lights, and also in solderers. One man had discovered that for a year his vision had been failing in the evening. Schanz believes that many cases of night blindness in soldiers, whose duties compelled twilight vision, were due to injury from light occasioned by their work, which only became apparent in military service. The large number of such cases of night blindness proves that injuries to the eyes of workmen by light has not been adequately noticed. Their "accustoming" themselves to intense light is in reality a diminution of retinal excitability, in which ill effect the ultraviolet rays bear a great part; such injury of the retina, terminating in

ion of the central portion structure (Van der presents the same process. which oppose the passage of let light are sufficient as a protection against daylight. Such glass would offer an obstacle to the passage of the rays of transition from the visible to the ultraviolet spectrum, for these are the most dangerous. Their color should, therefore, be yellowish green. It is somewhat different with artificial light, as in such light all the ultraviolet rays can be opposed by suitable globes. Schanz's euphos glass is adequate for all scientific and practical purposes; unfortunately the manufacture of such glass has, at present, come to a standstill.

In **Ewing's** first case, both eyes had been operated upon for cataract, with practically normal vision in the left eye. Eight years later, the patient spent several hours looking at liquid metal at white heat, and in two days a failing of vision was noticed. Examination showed a recent diffuse retinal hemorrhage about the size of the disc in the lower nasal portion of the macula, accompanied by slight grayish retinal edema. Several months later the vision was 20/60, and there was a dense central retinochoroidal scar.

In a second case, the left eye was blinded for a few seconds following a great flash of white heat from the explosion of a 150 watt electric bulb. The tenth day following the accident, the vision was 20/75. Ophthalmoscopic examination showed an extensive diffuse central retinal hemorrhage, and two others between the disc and the macula. Vision of the left eye gradually decreased to 8/150; right eye 20/20. There were a number of old retinochoroidal scars in the periphery, probably caused by an earlier severe blow on the top of the head. There was no edema of the disc or of the nerve fibers as there probably would be with such extensive hemorrhages, were they the result of disease. They all had the appearance of being traumatic in origin.

SCHOOL REFRACTION.—**Brinton** says he examines an entire school by retinoscopy, and is able to do as many as two hundred per hour, thus picking out the defective for later examination. He also examines for trachoma in a similar manner.

In Bristol glasses were prescribed for one thousand four hundred fifty-two children, of whom only five failed to get them. Dr. Greenwood reports for the County of Kent that 2 per cent of the school children have squint. Of cases of eyestrain, 60 per cent were due to hyperopia and 20 per cent to hyperopic astigmatism.

SCHOOL HYGIENE.—**Moxon** describes a desk for myopic children with which the eyes of the child are kept at a minimum distance from the work by means of a plate glass, under which the child does his writing, etc.

Bellin states that 20 per cent of all school children have refractive errors. He suggests special schools for those with defective vision, less home work and less story and novel reading, also discontinuing the practice of giving term examinations in studies for which the pupil crams and abuses the eyes.

Wick devotes sixty-one closely printed pages to a review of the literature of the controversy between those who favor Roman and those who favor Gothic script for German writing and printing; and to a report of the results of some detailed experiments which he has made as to the comparative facility which the two scripts afford for sideways vision, far point of legibility, and vision in diffusion circles as well as instantaneous reading. The author's principal conclusions are: that the Gothic script is decidedly superior to the Roman as to sideways vision (the ability to see words not directly looked at), instantaneous vision, and the frequency of ocular movements ("jumps" from point to point in the reading matter); that "German script" is justly so-called, having been elaborated by German minds, altho originally derived from Roman letters; and that while foreigners may find difficulties in the German language they never find any in the German script. It is interesting to note that the article is published in Roman type in one of the most scientific eye journals of Germany or of the world, Graefe's Archiv für Ophthalmologie.

PREVENTION OF EPIDEMICS.—**Morax** thinks that the difficulties of an effective campaign against trachoma are due to the following facts:

1. That trachoma is a familial disease and is often conveyed to children in infancy or early childhood.
2. That in many cases the affection is not accompanied by any symptoms; only by everting the lids is the disease discovered.
3. That therapeutic measures are frequently inadequate.

Inasmuch as reporting, segregation and other similar measures have failed to give adequate protection, future efforts should be directed toward determining the etiology and developing an effective treatment.

PREVENTION OF BLINDNESS.—**Harman,** reviewing causes of blindness in four thousand two hundred eighty-eight persons, shows that (1) in infancy about 50 per cent is caused by gonococcic infection; (2) in school children inherited syphilis causes more blindness than any other single cause; (3) these two combined cause more than half the total blindness in school children. He urges that, in addition to these two causes, attention should be concentrated on accidents and myopia.

Wright expresses the opinion that a great deal of total and partial blindness in Canada could have been prevented, if proper care had been given to the young. Both the public and the profession should realize that ordinary eye troubles should be treated in their initial stages.

Mayou states that the larger part of cases of *ophthalmia neonatorum* were blind on admission to the hospital, the average day of admission being the ninth day of the disease. This deplorable situation is charged to ignorance, and it is suggested that midwives, medical students, nurses and doctors be taught the proper handling of such cases. Regarding ophthalmia neonatorum, the state law of Oklahoma provides: immediate instillation of 1 per cent solution of silver nitrat or some other effective prophylactic. The State Board of Health furnishes 1 per cent silver nitrat ampoules on request. Physicians and midwives must state in the birth report whether or not silver nitrat was used. Failure to have the ampoules is no excuse.

The Committee on the Prevention of *hereditary blindness* states that there are between 5,000 and 7,500 persons in the United States blind from hereditary causes, and that the annual cost of caring for these is $2,000,000. It recommends that the simplest method to remedy this is by legislation, and suggests that where danger of hereditary blindness exists the contracting parties to marriage be required to furnish bond that the children, if any, will not become public charges.

Morlet in writing of hereditary optic atrophy as a possible menace to the community in Western Australia, takes up the symptomatology, prognosis and etiology of the disease. He gives a detailed description of a genealogic family tree. He forcibly points out that the only means of stamping out this menace is by preventing, as far as possible, the further propagation and spread of affected families.

Muskens states, that of one hundred inmates of a school for the blind more than 20 per cent had either certain or probable brain disease as etiology. These cases were either spontaneously, or too late operatively, cured to prevent blindness, and he thinks a competent neurologic examination very important in children showing defective vision.

White appeals for more careful attention on the part of the profession, to cases of commencing loss of vision, so that they may get the skilled treatment needed to save their sight. He calls attention to the fact that failure of distant vision usually means some pathologic condition. If, under such circumstances, the general practitioner would always refer the patient to the specialist, there would be fewer glaucomas miscalled early cataract.

Hirschberg states that, in Germany, blind men are being used as factory workers. Lack of vision is compensated for by enhanced capacity of other organs. They are especially adapted for machine work and even earn more than those who can see and thus have their attention distracted. The machines are fitted with safety devices adapted to the needs of the blind.

CONSERVATION OF VISION.—An editorial in the *Pennsylvania Medical Journal* states that the State of Pennsylvania has 445,000 children with defective vision. Of 42,000,000 men and women employed in industry in America, over 50 per cent have defective vision. In one company (Industrial) 83.3% of the employes were fitted with glasses, and production was improved 28% in comparing two months results.

McCord and **Lyle** deal with the actual waste in material and the loss due to accident incident to poor vision and recommend:

1. Best illumination possible for protection of workers.
2. Test visual acuity of all applicants for employment.
3. Send all with defects above 20/30 to the oculist.
4. Pay the oculist and deduct the fee from the workman's pay.
5. Select the job to suit the defect.

Hasler states that one fourth of all inhabitants of Europe and America have more or less of a visual handicap. Eye defects caused 10.65% of rejections from military service in the United States. He advises the education of the public and constant advice to patients.

In the discussion of methods of diminishing blindness in Mexico, **Graue** stated that there were about 15,000 blind among the 15,000,000 inhabitants of that country. He suggested as practical measures the education of all physicians as to certain points of ophthalmology: provision for the prompt treatment of all who have diseased eyes, especially skilled attention to ophthalmia neonatorum and general vaccination, the exclusion from the country of contagious eye diseases, medical supervision of the schools and prevention of industrial accidents to the eye. **Ruiz** gave as the three principal causes of blindness blennorrhagia, smallpox, and syphilis. He urged the importance of education of the public for their prevention. The statistics of **Gonzalez,** for the central tableland in Mexico, showed among 61 cases of optic atrophy, 17 due to syphilis, 11 to different forms of meningitis, 5 of alcoholic origin, 3 to puerperal infection and 2 each to cerebral tumor and the anemia of miners, while 17 were of undetermined causation. Of 58 cases of ophthalmia, 46 were in the newborn, 8 were blennorrhea of adults and 4 were from leucorrhea in girls. In 40 cases of retinitis, retinochoroiditis, etc., 17, were found to be syphilitic, 7 diabetic, 5 retinitis pigmentosa, 4 albuminuria, 5 detachment of retina, and 2 embolism of central artery of retina; of 38 cases of iritis and iridocyclitis, 20 were syphilitic, 17 "nonspecific" and one traumatic. There were 30 cases of ocular injuries, 30 of leucoma following keratitis, 27 of glaucoma, 24 of senile, 3 of infantile cataract, 20 of myopia, 12 of leprosy, 10 of small pox, and 17 of other etiology. Gonzalez also gives statistics of the curability of the different conditions, and reviews in detail the usual methods for the prevention of and cure of the various conditions considered, covering much the same ground as Graue.

Ophthalmic Sociology

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This review carries the literature to October, 1922. For previous references see O. L., v. 18, p. 527.

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DIGEST OF THE LITERATURE.

PROFESSIONAL RELATIONS, STANDARDS, ETHICS AND QUACKERY.—**Lewis** believes that the public should receive instruction in regard to the facts of our specialty. As it is, it receives false information thru the medium of inaccurate and misleading advertisements. Several examples of the latter are given, as well as one of a correct and proper advertisement. The best way to combat this state of affairs is not to wait until the harm has been done, but to counteract it before it has become harmful, by having some one accustomed to present facts to the public furnish it with correct information in the proper manner. He refers to the valuable bulletins and pamphlets of the Society for the Prevention of Blindness.

McIlroy states that the activities of the school oculist are along two lines; inspection, and treatment. The author's method of examination is described. As to the second activity, parents formerly objected to the treatment of minor ailments, which they regarded as discipline rather than therapy, and pointed out the presence of similar conditions in themselves as proof that it was unnecessary to treat them. This opposition is gradually vanishing. The education of the blind and semiblind is of the greatest importance, and their industrial efficiency is thereby greatly enhanced. Children who are blind, or almost so, should be taught in special classes in connection with the ordinary schools, and should receive oral instruction along with normal seeing children. They should, in addition, receive special instruction in Braille writing, geography by means of maps in relief, typing, basket making, twine work, etc.

Walker, in his presidential address before the Bristol Med.-Chir. Society, spoke of some of the quacks of former times and their methods. This included a number in England, France and Germany. In England were William Read, Roger Grant and "Chevalier" Taylor. Among their forms of activity, blood letting and couching of cataract are mentioned.

A committee of the Council of British Ophthalmologists, appointed to inquire into the referring of ophthalmic cases to hospitals for examination on the part of certain public authorities, reports that the postal authorities should include in their medical service the service of ophthalmic surgeons, who should examine the eyes of recruits, treat employes and furnish reports necessary for official action. Arrangements having been made for the examination of the eyes of army pensioners and claimants for old age pensions, it is outside the duties of medical officers of any hospital to make examination or report for either of these services.

OPTICIANS AND OPTOMETRISTS.—**Wuerdemann** reiterates that the sphere of activity of the optician should be confined to the mechanical part of furnishing glasses to those who require them. The practice of some physicians of referring refraction work to nonmedical men is strongly condemned. Attention is called to certain false statements contained in an editorial in the Portland Sentinel, and its character as a advertisement for a certain optician. **Stock** points out the line of separation between the work of oculists and opticians in much the same way as it has been determined in England and America.

VISUAL REQUIREMENTS OF SERVICES, OCCUPATION AND SPORTS.—**Mitchell** describes experiments for testing the vision of railway engineers under practical conditions. A standard signal arm subtends an angle of 5 minutes at a distance of 1.5 miles. A man whose visual acuity was 6/18 O. U. (combined 6/12), read the signal correctly at a distance of 1500 to 1600 yards. As these signals are so placed, that they come into view at a distance of 600 yards, it would seem that a vision of 6/12 allows a wide margin of safety. The results of the tests with night signals varied with the cloudiness of the signals, etc. It was found, however, that if vision with both eyes was as low as 6/12, the color perception of dull red lights was not dangerously lowered.

Piesbergen gives the results of the examination of 384 railway employes in 1920. Of this number, 54 were found to be color blind, when tested by Nagel's tables and the anomaloscope. Three color blind brothers were found to be employed as engineers. Of all the tests, the most exact and certain one is that with the anomaloscope. Railway employes are divided into four groups; according to their visual acuity: (1) V = 2/3 or more, without correction; (2) V = 1/10 — 1/4, corrected to 2/3; (3) V =2/3 — 1/3, with or without correction; and (4) V = 1/2 — 1/6, with or without correction. The kind of employment which is appropriate for the individual is determined by the degree of the visual acuity.

Taylor states that the army and mercantile marine are not as strict as they should be in adhering to their regulations.

Sharp gives the interim report of the American Illuminating Engineers Society to the International Illuminating Commission. It is divided into 3 headings: (1) performance on the road (brightness at different heights and distances; (2) laboratory tests; (3) supplementary regulations. **Mayou**, in a note on the Report of the Committee of the Ministry of Transport on light and vehicles, advises that headlights of vehicles should be turned out or dimned when passing each other. This procedure should be observed, at least, until properly designed lamps have come into general use.

Blindness, Teaching and Provision for the Blind.—According to **MacGillivray**: "A child is educationally blind who is suffering from any ocular condition which would be seriously aggravated by ordinary school work, and which would thereby materially retard his own education and in turn that of his class fellows." This of course includes the albino, the child with zonular cataract, corneal nebula, coloboma of iris and choroid, absence or dislocation of lens, buphthalmos, and defects of the optic tracts and centers. Old interstitial keratitis, hyperopic astigmatism and progressive or high myopia come within the same category. Such children should be sent to a special school for the blind or one for myopes. In such schools pupils are taught to avoid bringing their eyes close to the object to be seen. They are taught to read and do other things without use of sight. **Holm** states that in Copenhagen special schools for children with vision 5/24 or less are not needed as in Germany, there being only one among three thousand and no case of extreme myopia.

Caiger gives the statistics of 700 cases of ophthalmic pensioners. Of these, 7 were totally blind, 50 had vision in only one eye, 53 had had enucleation performed, and 1 was a case of sympathetic ophthalmia. Most of the cases of loss of vision in one eye were the results of concussion changes. There were three groups of refractive errors: (1) those who thought the trouble was due to one eye having to do the work of both; (2) headaches; and (3) neurasthenia. In all of these, the refractive error was the basis for the symptoms of which the patient complained. One case of functional blindness was found. This had been caused by a shell explosion, and was cured by rather heroic treatment. Malingering was found frequently. One of the patients had a corneal opacity, which had been caused by war gas.

Ruiz found that 30% of the blindness in Mexico was caused by blennorrhea. Gonorrhea is a very prevalent disease, and ophthalmia neonatorum is usually treated only by home remedies. Smallpox is the cause of 20% of the blindness, as vaccination is not compulsory and the Mexicans object to it. Syphilis, which is very prevalent in the cities, is the cause of 10% of the blindness. (If syphilis is so prevalent, it would seem that a higher percentage of blindness should be due to it, in view of the number and frequency of ocular lesions due to this disease. Rev.) The remaining 40% of cases are due to various causes, trauma, trachoma, etc.

Referring to what has been accomplished for the conservation of vision by earlier congresses of ophthalmology, **Park Lewis** urged that a part of the time at the Washington Congress should be set aside for a discussion of such topics and methods.

Avizonis gives a statistical, clinical and therapeutic report of the work done in a large area of Lithuania, but the work is published in Russian, only, and is accessible only to those who can read this language.

It is pointed out by **Lawson** that the problem of educating the child born blind and of reeducating the blinded adult are totally different, and that the latter is much the more difficult. The special reasons for this are that the adult already educated thru sight must now be reeducated on new lines; the difficulty increases with age and much depends on the patient's individuality. The reeducation must be individual. What is possible for one may be quite impossible for others. A great obstacle may be encountered in the mental attitude of resistance of the patient, or in advanced life a passive inability to take interest under new conditions. The society of comrades similarly crippled greatly helped the reeducation at St. Dunstan's. There is required a preliminary reeducation of the moral sense. It is essential for the blind man first to recover his lost independence, which the ministrations of friends may tend greatly to prevent. By living with others who are blind and such assistance to self help as the cane to feel his way, strips of carpet laid to guide him in certain directions, he must be made to feel that he can be largely independent. He must be taught to avoid being fed by another, but to learn to use his knife and fork without the guidance of sight. After this, social intercourse and regular physical exercises prepare him for intellectual and economic training, and the selection of a means of livelihood. The removal of all possible obstacles not due to blindness is important, such as crippling by other injuries or disease. The blind who have learned to do something require special oversight to see that they do not fall into the habit of inaccurate or defective work which they cannot perceive. They always require in some respects special environment and care. For those who have no homes, special clubs for the blind are urged. Persons who retain some useful vision must often be classed with the blind who are quite unteachable, along with some who have mental inaptitude or are cripples or disabled by disease. Marriage presents special difficulties for both parties, and should be entered into after most careful consideration.

Strehl, who himself is blind, has written a book describing the methods and the results of the modern care of the blind, especially of the war blind, their occupations and their relations to society as a whole. The book is made more useful by a number of tables of valuable statistics.

The seventh report of St. Dunstan Hostel and After-Care Organization for Blind Sailors and Soldiers, published in the *Lancet and British Medical Journal,* states that 406 patients were receiving training. Fifteen new cases were admitted in January. Not a single trained stenographer or telephone operator is out of a job. Great care must be taken in placing the graduates and in observing them afterwards.

Harman describes a new college for blind girls, recently opened at Chorley Woods, near London, under the auspices of the National Institute for the Blind. It is for the higher education of girls who are totally blind, or who have no useful vision.

Forsch describes the optophone, which is a reading apparatus for the blind. Black letters on a piece of paper are reflected into a selenium cell, which is connected up in a telephone circuit. Different tones are produced by different letters, and the blind learn to recognize these letters by these differences, and are thus enabled to read by hearing.

Jastrow comments on the case of a girl who was presented before the Chicago Medical Society, under conditions which were supposed to exclude all possibilities of fraud. She was 17 years old, was blind and deaf, and claimed that she possessed the ability to distinguish colors by the sense of smell, together with an increase in her tactile sense. Jastrow claims that this is a physiologic impossibility, and believes that the favorable reception accorded to her claims was due to the "will to believe" of the observers. The recognition of colors was probably due to the presence of a remnant of vision, which was not excluded by the method of testing employed. In reply to him, **Nagel** says that the occlusion of the eyes was perfect, since it was tested previously upon himself.

COMPENSATION.—The methods and standards for the evaluation of compensation for *industrial injuries,* as they relate to the eye, have been the subject of several communications during the past year. A well worked out, voluminous report was made by the *Committee on Estimating Compensation for Eye Injuries, of the Section on Ophthalmology of the American Medical Association.* It is a difficult article to abstract, and those interested should consult the original. Compensation is to be estimated on the degree of loss of (A) visual acuity (a) for distance, and (b) for near; (B) binocular single vision; (C) field of vision. 20/20 is taken as the standard visual acuity for distance and 20/220 as equal to economic loss or industrial blindness for distance, and this latter is awarded 50% compensation. For every increase of 10 in the denominator of the fraction 20/20, there is awarded 2.5% compensation. 14/14 is taken as the standard for near vision, the numbers representing inches, and 14/154 indicates industrial blindness for near work, and **is awarded** 50% compensation. Every increase of 7 in the denominator of the fraction 14/14 is awarded 2.5% compensation. Under (B), total loss of binocular single vision is awarded 25%. Under (C), contraction of the visual field to 60° entitles the patient to 2.08% compensation. For every additional 5°, additional compensation of about this same amount is added until it reaches 25%, which is when the field is contracted to 5°. The proportionate values are therefore:

$$A\begin{cases}(a)\\(b)\end{cases} = 50\% \text{ compensation}$$

B = 25% compensation
C = 25% compensation

Total loss of all the above entitles the patient to 100% compensation. Total loss of the eyeball is awarded 110% compensation. Cosmetic defects should be awarded additional compensation. Lesions causing disturbances of color vision, light adaptation, etc., should be estimated on the basis of loss of efficiency, and should be added to the amount for A (a) or A (b). Injuries involving both eyes should receive a compensation equal to the sum of the compensations for each eye, modified under certain conditions. If the vision of an eye was defective prior to the injury, compensation should be awarded only for that part of the visual loss which may be reasonably attributed to the injury.

Black makes the following recommendations:

(1) That the *economic* loss of the essential physical, physiologic and psychologic functions of both eyes, which combined constitute standard (normal) vision, be considered as 100% loss of efficiency, entitling the individual to 100% compensation.

(2) That the *economic* loss of these functions in one eye should entitle the individual to 50% compensation.

(3) That enucleation of one eye should entitle the individual to 60% compensation.

(4) That compensation be not awarded until all adequate and reasonable treatment has been carried out.

(5) That cosmetic defects should entitle the individual to additional compensation.

(6) That compensation be awarded as follows: loss of central visual acuity for distance in one eye, where working distance is greater than arm's length =

25%; loss of central visual acuity for near in one eye, where the working distance is less than arm's length =25%; loss of binocular, single vision= 10%; loss of depth perception = 5%; loss of visual field of one eye = 10%.

(7) That V=20/220 be taken as indicating industrial blindness. Every increase of 10 in the denominator of the fraction 20/20 shall correspond to a 5% loss of visual acuity. That 14/14 (inches) shall be taken as the standard for near vision, and 14/154 shall represent industrial blindness for near. Every increase of 7 in the denominator of the fraction 14/14 shall correspond to a loss of 5% visual acuity. Tables are given for the estimating of the percentage of central visual acuity for near in both eyes, loss of efficiency in contractions and other losses of the visual field, and for compensation for reduced visual efficiency for one eyed individuals.

Holt calls his method of estimating compensation the "natural science" method. According to him, the earning capacity (E) is equal to the product of the functional ability (F) and the competing ability (C); i. e., E=FC. The loss of an eye equals the loss of 18% of the total bodily functional ability, and the same is true of the competing ability. Therefore, 0.82F x 0.82C=E. Therefore, E= 0.6724, and the loss is 32.76%. If the weekly wage is $25.00, the compensation should be $8.19. Similar equations can be worked out for when C and F are different.

Smith, Tucker and **Prince** have constructed a chart where the lines indicate the relative percentage disability for any given loss of visual acuity at any age, in a low grade occupation. For the higher grade occupations, a method of triangulation obtains the correct results.

Wuerdemann gives the rules for awarding compensation used by the governments of the United States, Great Britain, France, Italy, Belgium and Germany. Those of the United States are given at some length, and include ratings for temporary partial, permanent partial and permanent total. They are too long to reproduce here. In regard to Great Britain, the report merely shows the number of cases of industrial disease for which compensation was paid. It does not show the amount or the basis. The French report gives the schedule of ratings for disability established by the decree of May 29, 1919, for application to the law of March 31, 1919, for War Injuries. It gives general rules and applications to various conditions, and cannot be condensed for reproduction here.

The Italian report gives the conclusions of the First National Congress of Eye Injuries. There are four subdivisions: (I) Lesions reducing the vision in one eye only; (II) lesions reducing equally the vision in both eyes; (III) lesions reducing the vision in both eyes in unequal proportions, and (IV) lesions that abolish the capacity of vision in one eye and reduce in various amounts the vision of the other. Tables are given showing the evaluations of these relations. In Belgium, there is no official scale, the percentage being determined by the judge. The German report is confined to a statement in regard to the various kinds and percentages of eye injuries, without recording the compensation.

Before the Omaha and Council Bluffs Ophthalmological Society, **Gradle** gives the views of the committee of the American Medical Society (see above). In the discussion, Dean called the method of Holt a natural science one, but thought it was too complicated, and that the element of individual judgment entered into it too much for exactness. Larsen, of the Nebraska State Compensation Board, approved of the attempt of the profession to establish a method of recording visual defects. Certain cases of injury are affected more severely than others, which should be taken into account. He deprecated the attitude of certain patients and lawyers, who refused treatment in order to obtain a larger amount for a greater resulting defect.

Siegrist reports that Swiss social insurance has allowed 10 percent compensation for the loss of an eye on account of mutilation, and 10 to 23 percent added for incapacity. The latter has been discontinued unless the other eye has lost vision. The Swiss Ophthalmic Society by a committee demanded that the compensation for mutilation be fixed at 20 or 25 percent according as the eye is retained or enucleated.

Mehl says that the New York Compensation Law does not provide a strict application of economic principles. For example, a watchmaker is paid for the same number of weeks as an unskilled worker. It is rather a condition of average industrial justice. In New York, between 20/20 and 20/100 is industrial vision, the latter amount being equivalent to industrial blindness. 20/40 vision means that the patient has lost 1/2 of his normal vision, altho from the standpoint of industrial efficiency, it may not mean 50% impairment of vision. The author presents a table where each increase of 5 in the denominator of the fraction representing the visual acuity is equal to a loss of 6 1/4% of industrial vision.

In his discussion of compensation laws, **Charles** calls attention to some of the discrepancies arising between different methods of estimating the economic effects of disability. He believes it is best for the visual acuity to be expressed in decimals, tenths for better vision and hundredths for poorer vision.

Allport draws attention to the difficulty of Industrial Commissions doing justice both to the employer and the employe. Their task may be lightened by having a mathematically correct graduated scale of visual loss percentages between 20/20, or normal vision, and 20/200, or industrial blindness. He suggests a table where for every increase of 10 in the denominator of the fraction representing the visions, there shall be considered a loss of vision amounting to 5%. According to his scale, 20/40 means a loss of only 10% of vision, instead of 50%.

Higbee recommends tests for the condition of the visual fields, as well as that for central vision. He advises nonoperative treatment of traumatic cataract.

The *British Journal of Ophthalmology* states that the Home Secretary has extended the provisions of the Workmen's Compensation Law of 1906 to cases of cataract caused by the exposure to rays from molten or red hot metal, since that form is very similar to glass workers' cataract.

The table of **Boldini** gives the following relations of visual acuity and loss of efficiency: 0.5 = 5%; 0.4 = 10%; 0.3 = 15%; 0.2 = 20%; 0.1 = 25%; 0.05 = 30%; less than that amount equals 35%. A vision of 1/20 with a normal visual field is the lowest amount of vision that permits ability to work. Where loss of vision has been present in one eye for some time and the other decreases in vision, the percentage is about 3 times as high. If an accident causes the loss of one eye, and at the same time decreases the vision in the other, the percentage is still higher, since the patient has not acquired the ability of monocular vision.

In discussing the relations of the ocular manifestations of hysteria to compensation, **Neher** reports 5 cases. He thinks the liberality of some of the authorities charged with compensations and benefits have stimulated the emotions to take charge of body functions, conforming to Osler's definition of hysteria, by producing disturbance of the function. These cases must be carefully diagnosed to distinguish true pathologic lesions, and the diagnosis withheld until all possible congenital defects or nerve lesion have been considered and eliminated.

MEDICOLEGAL. — **Waetzold** reports the two following legal decisions: The loss of an eye, blind since childhood, was awarded 20% compensation because it entailed less protection against foreign bodies, conjunctivitis, and decrease or loss of convergence. In the second case, that of a patient with a high myopia in the left eye, who lost the sight of the right eye as the result of glaucoma due to war injury, a decrease of 25% from the 90% awarded was demanded, because the left eye was not involved in the accident, its visual loss being congenital. The courts refuse to allow this, as the patient's occupation of book dealer could be carried on as well with one as with both eyes.

Hanke reviews the various ocular lesions which may be of traumatic origin, including tumors. In establishing the amount of compensation for loss of an eye, one must consider monocular central vision, visual field contraction, working time, and cosmetic appearances. He discusses, also, the compensation where the vision before the accident was below normal, and for conditions causing disturbances in the visual field, scotomata and heminanopsias, and pareses of the ocular muscles.

Waetzold states that the law recognizes two classes of war blind patients. In the first are those with high degrees of visual loss, i.e. those who with the best correction still do not obtain a vision equal to the ability to read, and who, therefore, are unable to work. Their vision is usually no better than fingers at 2-3 meters, and is usually worse, on account of disturbances in the visual field. They are given full compensation, which may be revoked if the sight improves. In class 2 are those who are completely blind, or so much so, that they are dependent on others. It includes those who are blind, or have simply light perception, or vision equal to hand movements in front of the eye, or a better vision with losses of the visual fields of great extent. Those who were blind or nearly so before the war are not to be considered war blind, since the war probably did not influence their condition.

Landolt relates the case of a soldier, who presented an injury to the arm, right ear, and double perforation of the left eyeball. The character of the wounds showed that the patient had been shot by his own gun from behind, due to the way in which it was carried, since he claimed that he had been injured only once, and no other position of a gun could cause the wounds found.

Ball relates the incident of a publisher who bound an old edition of a text-book on ophthalmology with a title page of more recent date, and sold it as the "last edition". He warns purchasers of books always to look at the date of the copyright, as that is the only legal and actual date of publication. He also proposes an amendment to the copyright law, to the general effect that the notice of the copyright shall appear whenever a date of publication or of issue appears. This will prevent the publisher putting out an old edition as one of recent date.

MISCELLANEOUS.—**Friedenwald** writes of ophthalmic references in the Bible and the Talmud. One of the Rabbis of the Talmud said: "The hand that without having been washed touches the eye deserves to be cut off, for it causes blindness". There were prominent Jewish oculists during the Arabic period and the later Medieval times. Among those of modern times are Liebreich, Javal, Schnabel, Koller, Hirschberg and many others.

Fox reports on 6 special clinics held at Philadelphia during three weeks in October, 1921. Cases operated on or shown were: 1 luxated cataract lens, 4 congenital cataracts, 2 conical corneas; 2 leucomata corneae, 2 trachoma, 2 strabismus, 2 chronic glaucomas, tarsalectomy, chalazion, cataract extraction, chronic suppurative dacryocystitis.

Jackson comments on the complaint of "boycotting the German Language" at the Washington Congress. It is customary to select only a few languages for such meetings. At the one under consideration, most of the men attending would be from England, France, Spain and the United States, and consequently the languages of these countries were made official. Italian, Dutch, etc., were not used, since all of the papers would be printed in all of the official languages on the program as abstracts, and too many would have made it too bulky. It was stated on the announcement that "each speaker in the discussion may use such language as he prefers, but the substance of his remarks must be furnished in one of the official languages of the Congress." (The Reviewer is a sincere friend of German Ophthalmology, and desires to take this occasion to warn German ophthalmologists that their actions are nagging, ill timed and childish, and only serves to alienate these who would gladly let "the dead past bury its dead.".)

Education, History, Biography

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This section carries the literature from October, 1921, to August, 1922. For previous references see O. L., v. 17, 1921, p. 534.

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DIGEST OF THE LITERATURE.

TRAINING IN OPHTHALMOLOGY.—**Jackson** reviews the progress of *graduate teaching* in ophthalmology, more particularly in the United States. During 1920-1021, the University of Pennsylvania offered a course in ophthalmology along the lines of a plan of preparation for special practice submitted twenty years earlier to Dr. Marshall, the dean of the medical department of the University of Pennsylvania. Similar courses have been carried on in the University of Michigan and the University of Minnesota, and less completely at various other institutions. But the opportunities for thoro *postgraduate training* in ophthalmic practice are limited to seventeen students at the University of Pennsylvania, ten at the University of Colorado, six at the University of Minnesota, and one at the University of Michigan; or less than forty in all. This is about one-tenth of the number who should be receiving such instruction every year.

The requirements for such instruction are divided into two groups of subjects: first the fundamentals, anatomy of the eye and related parts, including histology and embryology, physiologic optics, including refraction and ocular movements, methods of diagnosis, and special pathology, including pathologic histology, ophthalmoscopy and microscopy of the living eye; second, clinical work, the application of knowledge and skill to the individual patient. The suggestion is made that the *American Board for Ophthalmic Examinations* should divide its examinations into two parts, in the first dealing with fundamental branches and methods of examining the patient, and given any time after a year following the taking of the degree of Doctor of Medicine, and the second coming after one, two or three years of actual clinical work in ophthalmology.

The recommendations made in 1920 by the *Council of British Ophthalmologists* in favor of thoro practical training in ophthalmology, as a prerequisite to the passing of a qualifying examination in medicine, is supported by a recent report of the examination committee of the British General Medical Council, which recommends that candidates' knowledge of diseases of the eye, ear, and throat should either be efficiently tested in the final examination, or be established by evidence that they have been sufficiently instructed and tested as to their knowledge of these subjects.

A letter written by **Kress** offers to American postgraduate students some details of the abundant clinical facilities in ophthalmology which are available in London. The promotion of overseas and British postgraduate work is cared for by the "Fellowship of Medicine and Post-Graduate Medical Association," which was organized in 1918 under the presidency of the late Sir William Osler.

GROUP PRACTICE.—**Lewis'** discussion of the future of specialism in medicine devotes particular attention to the question of group practice. It is suggested, that in order that every physician may have access to all of the facts and all of the measures necessary for an adequate diagnosis and intelligent, scientific treatment of all of his cases, there should be established standardized diagnostic clinics in every hospital, to which any reputable physician should be invited to bring his cases for consultation. It is further suggested that the financial arrangements should be the work of a committee belonging to the hospital, so that as regards any case, the physician himself should not be concerned in the money involved in the transaction. **Mann** suggests that the best and most satisfactory way to organize a medical group on a firm and solid foundation is to form a corporation with a president, vice-president, secretary-treasurer, and board of directors, and with capital stock sufficient to own and operate its own clinical buildings and hospitals. The corporation should be owned or controlled by the staff, and the members of the staff should be paid both a salary and a commission, depending upon the earning capacity of each department.

LITERARY ERRORS.—A paper by **Ball** discusses errors in ophthalmic literature, as regards dates, facts, the spelling of names, and the citation of references.

HISTORY AND BIOGRAPHY.—**Marquez** describes in Spanish the medical festival held at Tournay, Belgium, on September 25, 1920, in memory of *Michael Brisseau.* Tournay, the birthplace of Brisseau, was then a French city, altho now a part of Belgium. A brief note by **Rochat** relates to the memorial to *Donders* which was unveiled in Utrecht, Holland, on June 22, 1921. The monument was to have been ready on May 27, 1918, the hundredth anniversary of Donders' birth, but this became impossible on account of the European war. The centenary of the birth of *Helmholtz* is the occasion of a short paper by **Dimmer,** who recalls to some of the older European ophthalmologists a memorable session of the Heidelberg Congress in 1886, in which Helmholtz was the first recipient of the Graefe medal, the special address of the occasion being delivered by Donders.

Some of the choicer passages from the reply made by Helmholtz are quoted verbatim.

Cumston's brief historical summary of the treatment of *trachoma* deals especially with the *Arabian school of medicine.* The remedies for trachoma employed by the ancient Greeks, among whom granular conjunctivitis was possibly more prevalent than is generally suspected, included copper, unripe grape juice, the cautery iron, and friction with cuttle-fish bone or with pumice stone. The classic Arabian book on ophthalmology was the "Tadkirat-el-Kahhalin," or "memento for oculists," written at Bagdad in the eleventh century. The fourth chapter of the second book of the "Tadkirat el Kahhalin" deals with trachoma, and is given in full in an English translation from the French version of Haddou.

Woelfflin has had an opportunity to study the oldest *hieroglyphic* passage which points to the existence of an oculist, the probable date being 2,500 years B. C. The inscription, which is translated and reproduced in a sketch, was found on a stone from the grave of a potentate of the old Egyptian empire.

According to **Lachs,** the first vestiges of ophthalmologic specialization in Poland date from the fifteenth century. The ancient *Polish* oculists were for the most part foreigners, and two out of four of them in the sixteenth century were Jews. They were frequently made subject to contracts, under which they were penalized for unsuccessful treatment or the unhappy outcome of an operation.

The account given by **James** of *"Sir William Read,* Knt., oculist to Queen Anne and to George the First, quack, mountebank" is interesting alike because of its sidelights on the status of ophthalmic specialization at the end of the seventeenth and the beginning of the eighteenth century, and because of its abundance of amusing detail concerning the *quackery* which was then rampant, especially in fashionable, noble and royal circles of Great Britain.

Read was appointed Oculist in Ordinary to Queen Anne in 1705, and was knighted in 1707 for his "great services in curing great numbers of soldiers and seamen of blindness, gratis." About ten years earlier he had advertised in the Tatler that he had been couching for thirty-five years, taking off wens, curing wry-necks and hare-lips without blemish. In 1706 he published "A Short but Exact Account of all the Diseases incident to the Eyes". Read's famous advertisement "Post nubila phoebus. Nihil absque deo" ("After clouds the sun. Nothing without God") is given in full. It contains references to cures of blindness, cancers, wens, hare-lips, wry-necks, dropsy, fractured skulls (by trephining) and leprosy.

The British Medical Journal summarizes a presidential address in which Walker gave to the Bristol Medico-Chirurgical Society a racy account of the activity of the quack in the treatment of eye diseases. During the middle ages, treatment of disease of the eye was very largely in the hands of itinerant quacks, who went from fair to fair selling nostrums to the credulous, and couching cataracts when occasion offered. Coming down to modern times, Walker suggests that the best check to quackery is the provision of a sufficient number of capable practitioners able and willing to undertake ophthalmic work.

The name *scissors spectacles* is applied by **von Pflügk** to a special form of folding spectacles from the eighteenth century. The account is accompanied by a number of excellent illustrations. The two hornrimmed lenses folded into a leather sheath. When opened the outfit had to some extent the appearance of an old fashioned clock hand, and it was probably developed originally from a type of spectacles of the beginning of the seventeenth century, actually known by the name of "Weisser" (an old word for the hand of a clock).

Von Pflügk has prepared a sort of catalogue of German and Dutch *coins* and *medals* upon which spectacles are represented. His classification is arranged under two principal headings, first spectacles as an optical instrument, second spectacles as a symbolic numismatic picture.

Koby has studied the Greco-Roman marbles in the Louvre museum in Paris, as to the different ways in which they represent the human eye. In perhaps ninety percent of the *statues*, the eyeball presents no detail of design. It must be remembered, however, that many of these eyes were painted. No antique marble contains an attempt at representation of the cornea by a local prominence. This is true even of colossal statues. There is often a flattening to suggest the cornea, or even a slight depression. In the few cases in which an attempt at detail was made, the limbus was indicated by a circular furrow, and the pupil by a heart-shaped or bean-shaped depression, the hilus of the bean being at the upper border, and evidently representing the light reflex.

EXAMINATIONS, CERTIFICATES, AND DEGREES.—The British Journal of Ophthalmology gives particulars concerning the *Diploma in Ophthalmic Medicine and Surgery* of the Royal College of Physicians of London and the Royal College of Surgeons of England. The establishment of the diploma in 1920 was the result of a request from the new British Ministry of Health. The examination is divided into two parts; the first dealing with anatomy and embryology, physiology and elementary optics; and the second with ophthalmic medicine and surgery and ophthalmic pathology. Both parts of the examination are held twice a year, in January and July. An indirect result of the establishing of the diploma has been the stimulus it has given to the study of the preliminary scientific subjects upon which the practice of ophthalmology ought to be based, and three of the special ophthalmic hospitals in London are now providing courses of study in the subjects covered by the first part of the examination.

OPHTHALMIC HOSPITALS.—**Derby** outlines the medical *social service and follow-up work* at the Massachusetts Charitable Eye and Ear Infirmary. The work of this special department is found particularly useful in the following classes of patients: (1) Dangerous acute conditions for which there is not room in the hospital, and yet in which no chance should be taken that the patient will not return to the clinic. (2) The noncongestive glaucomas, in which the patient thru ignorance may fail to persist in the use of miotics, or may neglect to come for regular observation. (3) The cases of ocular tuberculosis, to which Derby closely relates phylctenular disease. (4) Cases of interstitial keratitis. (5) Cases of ophthalmia neonatorum. (6) Cases of myopia. A further important phase of follow-up work is the routine return of selected cases each year, so that the final results of operation and treatment may be learned.

Howard of Peking gives an account of a visit to *Komoto* of Tokyo, who is widely known in Japan as its "father of ophthalmology." He has been professor of ophthalmology for thirty years, and in 1920 he and his four full-time assistants treated approximately 8,000 new eye patients. Pathology and bacteriology are given a large place in his regular departmental and postgraduate work. The undergraduate course in ophthalmology at the Imperial Medical College in Tokyo consists of 108 hours of instruction and is given in the senior or fourth year. Those Japanese physicians who wish to obtain postgraduate eye instruction are admitted as assistants and contract to remain at least a year in that capacity.

The *Union Medical College,* Peking, China, and the work of its department of ophthalmology are described by **de Schweinitz,** who took part in the formal opening of the college in September, 1921. The department of ophthalmology of the college is under the direction of Dr. Harvey J. Howard. Fully 60 per cent of the new patients have trachoma or its sequels. Admirable opportunities in the study of ocular pathology are afforded by specimens sent in by medical missionaries from all over China. Cataract is comparatively uncommon in north China, but glaucoma is common.

Smith of India describes his surgical tour in the United States and Canada, and especially the large clinical material which was brought together at short notice, by surgeons who wished to see Smith do his *intracapsular operation.* Many of these cases are said to have been doubtful risks, but the fact was recognized by patient and surgeon. Remarking upon the enthusiasm of the American physician and surgeon for new ideas, Smith regrets that postgraduate instruction in the British Isles does not go farther to meet the requirements of the American postgraduate student.

The Albert *Sarraut Ophthalmologic Institute* at Hué in the French province of Annam, inaugurated in September, 1921, and noticed in the Annales d'Oculistique, was prompted by the discovery in 1916, during the great war, that of 125,000 Indo-Chinese who were recruited for the French army, 35 per cent were disqualified for service as the result of *trachoma.*

OPHTHALMOLOGIC MEETINGS.—**Jackson** writes on the purposes and advantages of the *Washington International Congress of Ophthalmology,* and gives postsessional accounts of the Congress and of the meeting of the American Ophthalmological Society which followed it in Washington. Other postsessional accounts of the Washington Congress are given in the Bulletin of the Academy of Medicine in France, by **de Lapersonne,** who represented the Academy at the Congress; and in the Eye, Ear, Nose and Throat Monthly.

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